Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

Vol. 72—No. 20. CHICAGO, SATURDAY, MAY 18, 1918. Page 825.

Fig. 1.—An Architect's Reception Room. Most Light Is from Indirect Unit. Wall Brackets Are Chiefly for Decorative Effect.

Fig. 2.—Private Office With Attractive Semi-Indirect Bowls of Heavy-Density Glass.

Lighting of Offices and Drafting Rooms

First Part of an Article Discussing Office Lighting on Modern Lines—Quantity and Quality of Light Needed

By WARD HARRISON

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TODAY there is no reason for other than the best illumination in new offices. Equally good lighting should also be provided in the older buildings, although here the result is attained at a somewhat greater expenditure, for in the majority of cases some change in the location of outlets will be necessary. In general, however, the required alterations in wiring will be found profitable even where considerable expense is involved, *for there are no locations where the consequences of poor lighting are more serious or more keenly felt than in offices and drafting rooms.* In this article it is assumed that nothing short of the best lighting is desired in either old or new buildings, and the space is devoted to a discussion of the methods by which such results may be obtained.

From the standpoint of utility, the problem of office lighting can be very simply stated. Fundamentally it is to provide the best illumination for sustained vision of flat surfaces in horizontal or slightly oblique planes in which papers, books, and photographs are usually examined. The perception of objects in their three dimensions, so important in the industries and in the arts, is here relatively unimportant. On the other hand, experience has shown that in offices and drafting rooms perhaps more than in any other locations an ample intensity of soft, well-diffused light must be provided in order that discomfort may be avoided and that the eyes may not become excessively fatigued by close application for long periods of time. There should be no extreme contrast in the brightness of objects within the field of view; shadows should be subdued, if not entirely avoided; the lighting system should be designed to permit flexibility in the arrangement of office furniture; it should be easy of maintenance and satisfactory in appearance.

In this article the subject of office lighting is discussed under five principal subdivisions:

1—Quantity of light;
2—Quality of light—choice of units;
3—Utilization of light;
4—Location and number of lighting units;
5—Illumination calculations.

Quantity of Light.

In the normal process of seeing, the eye is called upon to adjust itself for illumination intensities which vary from several thousand foot-candles outdoors on a sunny day, to small fractions of a foot-candle in the same location at night, when the moon or street lights

Fig. 3.—Typical Units of the Three-Desirable Office Lighting Systems.

furnish the illumination. At the very high values, a blinding effect from the large volume of light reflected to the eye obliterates detail, while at the very low values, the quantity of light reflected is so small as to render accurate discriminiation impossible. Between these limits there is a wide range of intensities at which good vision is possible; considerations of economy naturally limit the intensities employed in artificial lighting to the lower values of this range. So closely is the lower limit approached, in fact, that it is necessary to differentiate between the classes of work for which the illumination is to serve. Thus, while intensities of from 4 to 8 foot-candles are considered good practice at the present time for general office work, intensities of from 8 to 12 foot-candles are desirable for drafting rooms; intensities up to 50 foot-candles from properly diffused sources would do no harm.

In designing a system of office lighting, it should be remembered that standards of illumination intensity are rapidly and continuously rising as tenants and building managers come more and more to appreciate the value of good illumination. Furthermore, allowance should be made for the fact that even in a small group of persons, one or more with defective eyesight will usually be found, and the lower limits of permissible intensity should not be approached so closely that unnecessary hardship is imposed on anyone. Again, it should be remembered that even where individual lamps are supplied for the illumination of the desks, a general illumination over the entire room of at least 1¼ foot-candles should also be provided.

Effect of Color on Quantity.—The experience is not uncommon to those who occupy offices for which daylight furnishes illumination the greater part of the time, that, as the natural light begins to fail and the lamps are switched on, the artificial illumination is seemingly inadequate—although at night the light is entirely satisfactory. This is due in part to the fact that the eye is, at this time of day, suffering from a certain degree of natural fatigue and in part to the disinclination of the eye to adapt itself to a lower intensity. Again, toward evening the horizon, as seen through the windows, is frequently even brighter than at midday and this, by contrast, makes the interior illumination seem even more inadequate. The difference between the color of artificial light and that of daylight also appears to be partially responsible for the same impression, and a combination of the two is displeasing to many. In such cases Mazda C-2 lamps, which give illumination like sunlight in color, are desirable. These lamps are particularly serviceable where, as is often the case, artificial light is used at all working hours to supplement daylight in a room having insufficient window exposure. In fact, if such lamps are used in indirect fixtures, they will often pass unnoticed and thus render profitable an office for which it would otherwise be difficult to secure a satisfied tenant.

Quality of Light—Choice of Units.

The science of lighting was first developed from a quantitative standpoint, and properly so, but as a result, intensity and efficiency became the only factors to which importance was attached in judging a lighting installation. Of late a growing appreciation of the qualitative aspects of lighting, together with its constantly decreasing cost, has subordinated the question of quantity to that of good illumination, which in a broad sense means illumination of the proper intensity and of the proper quality. In many cases a typical modern office lighting installation will show little or no smaller energy consumption than will one of older design using the early tungsten-filament lamps, but today there is no question as to the wisdom of taking advantage of lamp and reflector improvements in the form of better illumination rather than in reduced cost.

Brightness Contrast—Glare.—Soft, diffused light is now recognized as essential to good office illumination. For this reason, direct-lighting units of the open-reflector type are giving way to direct-lighting units of the semi-inclosing type, semi-indirect units employing bowls of heavy-density glass, and totally indirect units; typical units of these three types are shown in Fig. 3 and in the illustrations which appear throughout this article. Extreme contrasts, such as exist between the brilliant filament of a lamp in an open reflector and the general level of brightness of a room are capable of producing marked discomfort or glare. As a matter of fact, nine out of ten semi-indirect bowls now on the market are of too light density glass and are therefore also unsatisfactory from this standpoint.

Investigation by Dr. Nutting and others has shown that for the general level of illumination intensities which obtains in interiors, the contrast in brightness between objects in the central portion of the field of view should not exceed 1000 to 1, if an immediate sensation of discomfort is to be avoided. This ratio is about what would exist if a 300-watt Mazda C lamp in a 10-inch opal ball were to be used in a room of

Fig. 4.—Simple and Effective Semi-Indirect Lighting. Depolishing the Ceiling Would Improve the Effect.

medium color tone. Where, as in offices, the position of a light source with respect to the eye must remain practically without change for considerable periods of time, fatigue rather than instant discomfort becomes the determining factor, and contrasts should be further limited to a ratio of 100 to 1. This means that the intensity of a source within the field of view should not, as a rule, exceed ½ candlepower per square inch of apparent area (about the intensity of a 10-inch opal ball of medium-density glass used with a 60-watt Mazda lamp) and consequently for the best results the choice of units is practically limited to totally indirect and dense semi-indirect fixtures.

An additional advantage possessed by light sources of a low order of brilliancy is that their reflections in polished surfaces are less harsh and annoying. In many cases desks are thoughtlessly given a high polish —not infrequently they are topped with plate glass— and in such cases the reflection of a source may approach in brilliancy that of the source itself. It is difficult to avoid reflections entirely, but the harmful effects can be minimized by employing only units which are of low brilliancy, and by arranging them carefully with respect to the position of the desks, or vice versa. It is often possible, in the case of small offices where single desks are used, to arrange the desks along the wall so that those occupying the office have the light sources at their backs. In this way reflections in desk tops are avoided and the walls, unless highly finished or hung with pictures framed behind glass, will not give rise to objectionable reflections. Side walls of considerable area should not, it may be emphasized at this point, be finished so near to white that they will reflect a large volume of light into the eye, nor should they be so dark as to cause undue contrast and needless absorption of light. The annoying effect of a considerable volume of light reflected to the eye from blank walls is probably more marked in daylight than under artificial lighting conditions; for in the former case vertical surfaces receive the greater part of the flux while in the latter the greater portion is directed to horizontal surfaces.

Even in buildings where careful attention has been given to the design of the lighting in the offices themselves, an annoying drop in intensity is frequently apparent when one steps into an elevator. The adaptation of the eye is not instantaneous, and a person going from one intensity to another naturally moves slowly and with caution. Where, as in large modern offices, the time of a very large number of persons is dependent to a considerable extent on the elevator service, proper lighting of the cars deserves considerable attention.*

Fig. 5.—Same Units as Shown in Fig. 4. Ceiling is a Very Light Cream in Eggshell Finish.

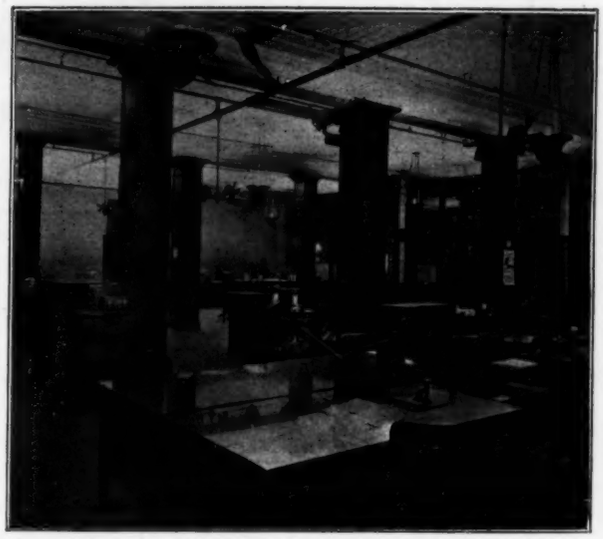


Fig. 6.—Totally Indirect System in a General Office. Even With Such Perfectly Diffused Light, Specular Reflection is Apparent in the Glass Coverings of the Desks.

Shadow.—Although shadows are very helpful in determining the shape and relative proportions of objects, they are not strictly necessary for the usual office where the work is largely with plane surfaces. In fact, an excess of shadow is likely to prove a decided nuisance; only enough to retain the natural appearance of objects and persons should be permitted. Dense shadows, such as those cast by a single unit of high intensity and relatively small size, or shadows with a series of sharp edges, such as cast by several small units, are particularly annoying. To be satisfactory from a shadow standpoint, light sources should be of large area and low brilliancy, in order that such shadows as do form will be luminous, with gradually fading edges. As a rule, the minimum of shadow obtains with totally indirect units, since they distribute the light over a large portion of the ceiling whence it is diffused throughout the room; the maximum of shadow which does not prove objectionable in office lighting obtains with direct-lighting semi-inclosing units of large size. In the opinion of many authorities, semi-indirect or luminous-bowl indirect units, which provide, in addition to the light they send to the ceiling, the direct light of the bowl to produce reasonable highlights and to destroy the effect of flatness, are the most satisfactory for office lighting.

It is of particular importance in the case of drafting rooms that the light be highly diffused in order that shadows may be avoided. Totally indirect and dense semi-indirect units are the best for the purpose where the ceiling is light in color or can be made so. Where conditions are such that it is impossible to make the ceiling a good reflector, units of the semi-inclosing type should be employed and special care should be exercised to see that the upper reflector is of large area and the bowl of large size and low brilliancy. It will often be

*For further information on elevator lighting, the reader is referred to a paper, "Economics of Office Building Lighting," by Samuel G. Hibben, in the Transactions of the Illuminating Engineering Society, Vol. XI, No. 9.

found more satisfactory from a lighting standpoint, and just as satisfactory from other standpoints, to work upon the dull side of tracing cloth rather than upon the shiny side.

TABLE NO. 1.

COMPARISON OF LIGHTING EQUIPMENTS FOR OFFICES.

LIGHTING UNIT	GLARE DUE TO EXCESSIVE CONTRAST WITH BACKGROUND	GLARE DUE TO SPECULAR REFLECTION	SHADOWS
Direct Open-Reflector	Not Satisfactory Unless units are out of ordinary range of vision.	Not Satisfactory Unless units are behind or to one side of user.	Not Satisfactory Unless units are to left side of user.
Direct Semi-Inclosing	Not Satisfactory Unless units are out of ordinary range of vision. Suitability depends on bowl density and size.	Fair to Poor Unless units are behind or to one side of user.	Fairly Good With large units.
Semi-Indirect Light-Density Glass	Not Satisfactory Unless units are out of ordinary range of vision. Suitability depends on bowl density and size.	Fair Suitability depends on density and, somewhat, upon size.	Fairly Good With large bowl.
Indirect or Semi-Indirect Heavy-Density Glass	Satisfactory	Usually Satisfactory	Satisfactory

Comparison of Lighting Units.—In Table 1, a comparison of office lighting equipment is made on the basis of their suitability as regards brightness contrasts, specular reflection, and shadows. From the data presented in this table and in the preceding paragraphs, the following conclusions may be derived:

1—*Open-reflector units are not suitable for large general offices* from the standpoints of brightness, specular reflection, or shadow. A single direct-lighting unit, if of large area and low brilliancy, would be satisfactory for one person alone in an office when so located as to bring the light over the left shoulder. It should be designed to illuminate the surroundings to a fair intensity.

A desk lamp, if properly designed, might prove satisfactory in a private office when supplemented by auxiliary lighting. However, such a lamp should not be located over the center, but to one side. Desk lamps are not as a rule satisfactory for general offices in which several persons are employed.

2—*Semi-inclosing units are preferable to open-reflector units of office and drafting-room lighting.* It is important that they be of large size and that the density of the glass bowl be such that they are satisfactory from a brightness standpoint.

Care must be used to place them so that specular reflection toward the eyes will be avoided as far as practicable. Semi-inclosing units are usually the best solution of the problem where it is actually impossible to obtain a light ceiling.

3—*The legitimate field for light-density semi-indirect units as applied in office lighting is extremely limited.* They produce somewhat the same general lighting effect as direct-lighting units. Where the ceiling does not present a reasonably good reflecting surface and where it cannot be made into a good reflector, *semi-inclosing* units are, however, more efficient than *light-density semi-indirect* units and are equally good in most other respects. Where a ceiling of reasonably good reflecting power is obtainable, *dense semi-indirect* units are to be preferred.

4—*Semi-indirect units of dense glass and totally indirect units are, in general, preferable to all others for office lighting where a ceiling of good reflecting power is obtainable.* Brightness contrasts can be made entirely satisfactory, specular reflection is reduced to a minimum, and objectionable shadows are avoided. A lighting system of such units permits maximum flexibility in the arrangement of furniture in a general office and is usually the most practical system for a private office as well.

Obviously, it is important that, whether indirect, dense semi-indirect or semi-inclosing units are selected, there be no unnecessary waste of light due to improper design. Whether the reflector proper is of mirrored-glass, opal, porcelain, or other material, it should be designed to permit easy cleaning, and should be hard and smooth in order that it may serve as a good reflector and be slow to accumulate dust; the contour should be such that light will not be pocketed and lost.

Fig. 7.—Totally Indirect Lighting of a Drafting Room.

(*To be continued.*)

OVER 165 MILLION TUNGSTEN LAMPS SOLD LAST YEAR.

The total sales of tungsten filament lamps in the United States, excluding miniature lamps, for the year 1917, aggregated, in round numbers, 165,000,000, an increase over the previous year of about 14 per cent. The total number of miniature lamps sold was 75,000,000. This is an increase of about 40 per cent over the previous year. The sale of tungsten filament miniature lamps, since their introduction in 1907, has increased by leaps and bounds. The majority of these lamps are used for flashlights and automobiles, but a considerable number are also used for candelabra and decorative lighting.

The relative importance of lamps having a carbon filament, i. e., the carbon and Gem lamps, has decreased each year, so that at present it is about 12 per cent of the total, whereas 11 years ago it was nearly 100 per cent. At that time practically no tungsten filament lamps were sold.

Presentation of a Case Before a Public Utility Commission

Thorough Preparation of Facts Will Obviate Delay in Reaching Decisions—What the Company Must Do to Co-operate With Commission

By HAROLD L. GEISSE

Secretary, Railroad Commission of Wisconsin.

[*With the advancing costs of fuel, labor and material and the impossibility of raising capital, public utilities are, for the first time in their history, forced to go before the Commissions to secure relief in the way of increased rates. Mr. Geisse, in this article which is abstracted from an address before the Wisconsin Electrical Association, presents some excellent suggestions for obviating the delay in securing decisions.*]

One of the most frequent criticisms of the Commission is that of delay in rendering decisions. The Commission is ready to admit that it is often unable to dispose of matters pending before it with that dispatch which would best subserve the interests of the public and of the utilities under its jurisdiction. The delay in many cases is due to inability to arrive at a conclusion as to the merits of the controversy from the evidence introduced at the hearing. If a better understanding of the method of preparing a case could be given, a greater volume of business could be handled with a much reduced lapse of time.

The Attorney's Help.

The utility desiring to obtain an increase of rates, or the public desiring to contest an increase, or to secure a reduction of rates, usually seeks the assistance of a lawyer, who is often as much at sea as his client on what to prepare for the hearing and how to present it. The case does not "make itself" by the logical marshaling of documents, opinion testimony, or the statements of eyewitnesses, as does the usual action in a court of law. If the attorney represents the company he seldom has that knowledge of accounting or of operating that will enable him to determine what points and proof thereof are really vital for the Commission's determination. If he represents the public he is still more in the dark, as to how to get at any facts that will be of import in the controversy. The Commission fully sympathizes with the village or city attorney who is thrown into a character of proceeding for which he cannot marshal a single bit of pertinent or illuminating testimony because of the inaccessibility of the sources of information. The result is that the Commission is obliged to resort to an inquiry into the books and accounts of the company and a statistical analysis of the operating performance of the plant for some years back or lengthy service investigations to secure the facts upon which to determine whether or not the relief sought is justified; and in a fair percentage of the cases the record of the hearing is incumbered with a mass of irrelevant testimony, inexpert opinions and even vituperation, to which the Commission has been obliged to patiently listen. One of the recurring incidents in hearings is the attempt to influence the judgment of the Commission by the introduction of prejudicial matter.

Commission Not a Court of Law.

Some thought should be given to the precise nature of the Commission, which is not a court of law. It is an administrative body, designed by the legislature to determine what rates may justly be charged by public service corporations, what rules and practices may be enforced by them in the conduct of their businesses, and what extent and character of service will adequately meet the honest requirements of the public. Its business is to fix rates, to pass upon the character and quality of service, to pass upon rules and regulations under which service is given, to inquire into the methods of keeping accounts and the business management, to prevent the interference of one utility's lines and facilities by those of another, and to approve methods of construction. In performing this function it is interested solely in finding out the facts. It is concerned in accounts, in operating statistics, in unit costs, in prices of materials and supplies, in coal costs, in values of property, in measurements and surveys, in traffic counts and in the opinions of experts.

Service and Rate Cases Differ.

One cannot attempt to outline a procedure for each character of case that may come before the Commission. A service case will differ much in its method of presentation from a rate case, but, to illustrate how plain and matter-of-fact a case may be made, we will follow through in its simplest form a typical case in which rates are involved.

Determination of Values.

The elemental question in a rate case is the determination of the value of the property used and useful in the service of the public. It is upon this fair value that the lump sum to be allowed as return is based. The lower the value found, other things being equal, the lower will be the rate schedule. In determining the ultimate fair value, the physical value of the tangible property, the amount of going value and the necessary working capital to be allowed must all be considered. The opportunity to affect the judgment of the Commission commences with the engineering appraisal of the physical value of the property. The engineers of the Commission have returned their report upon the physical value and copies of the report have been submitted to both sides in the case. It is possible that, in making the appraisal, the engineers have overlooked some element of the property, have failed to allow for mishaps in building the plant which increased the money expenditure necessary to its construction, or have allowed too liberal a value for the land or other elements included in the appraisal. On any of these points the Commission would be glad to have enlightening testimony. Possibly a contention would be in point at this juncture that the amount allowed for engineering and superintendence during construction is excessive or inadequate, and the testimony of experts or persons who are familiar with the history of the plant during its construction would be of assistance.

Having concluded the testimony on the physical

valuation, the amount of going value and of working capital to be allowed are proper subjects for consideration. The various theories of computing going value as discussed in text-books, prior decisions and monographs of experts furnish a fertile field of inquiry for persons preparing to present a case before a commission, and the amount of working capital necessary to conduct any particular business is sufficiently vague and uncertain to permit the litigants opportunity to present very helpful testimony.

Operating Expenses.

Completing the inquiry into the value of the property, an analysis of the operating expenses becomes necessary to determine that no improper charges are being included and whether or not the property is being fairly and economically managed. If the case under consideration arises through a public attack on the rates charged, it is probable that the representatives of the public will be able to present little testimony of assistance. Frequently testimony is introduced showing that the rates charged by the company under attack are in excess of those charged by other plants similarly situated in communities of approximately the same size. Such testimony is usually of little significance because of the factors that make the amount of the investment and the operating costs vary in different communities. If, on the other hand, the case arises through an application of a company for authority to increase rates, the company should be able to present a thorough analysis of its operating costs and earnings. Prepared with sufficient care, such a statement can be of material assistance to the Commission. Data relative to the degree of saturation attained in the community, presenting a statement of the kilowatt hour sales per capita and the gross earnings on the per capita basis, can frequently be shown with considerable effect.

Summing Up the Business.

An interesting disclosure of the tendency of the business can be made by drafting lines showing the course of the gross revenue, the net earnings, the operating expenses, the kilowatt hours sold, the car miles run and other elements or activities of the business. If it is desired to show the comparative course of these elements of the business activity of the company, the figures on gross and net revenue, operating costs, kilowatt hours or cubic feet sold may be reduced to their logarithmic equivalents and the lines drawn from the data thus produced. A system of logarithms being a system of ratios, the relation of the lines to one another may thus be made to appear very graphically. Run through a series of years, a chart of this character would show definitely the proportionate increase or decrease of the net earnings or operating expenses. Logarithmic drafting paper prepared for this purpose can be obtained of supply houses. Many modifications of charts of this character may be designed to assist in presenting the case of the applicant in a manner calculated to help the Commission in its studies of the facts presented.

Bonds and Stocks.

In many cases it becomes of importance for the Commission to know the amount of bonds sold, the selling price and the amount of capital realized from this source, and to have similar data relative to issues of stock, notes or other evidences of indebtedness. Companies should be prepared to show this, and also the extent to which earnings have been reinvested so as to reduce the necessity for security issues. Where security issues of considerable size have been put out, the conditions of the money market when the securities were issued is important.

Data in Rate Cases.

It is possible for companies to come to hearings in rate cases with a complete analysis of consumer data ready to be submitted. No more helpful information could be prepared than this in any rate case of prime importance. If submitted it should be arranged in such shape that the effect of a change of rates as proposed could be estimated. Statistics relative to the efficiency of operation are often of great importance. In times like these, particularly where applications for increases of rates are presented based on alleged emergency, detail should be submitted showing just what changes from normal expense are taking place.

In placing data in evidence an officer of the company should be prepared to explain it in detail, answering any questions relating thereto that may be propounded either by the Commission or by representatives of the public. Similar carefully prepared data should be provided for presentation in any service case, the object being held constantly in mind to cut down the amount of inquiry that the Commission must make independently after the hearing before decision can be rendered. With the figures carefully compiled, introduced and explained at the hearing, only such investigations would be required as would satisfy the Commission of the fairness with which they have been compiled, their completeness, and the safety with which conclusions may be drawn from them.

Should Disclose Facts Prior to Hearing.

Often it has been found to be true that municipal authorities desire time to study the evidence introduced by a company before the municipality puts in its case. A request for time when the municipality has had no prior knowledge of the kind of case the applicant is to present is entirely reasonable. If, on the other hand, the company has been sufficiently frank with the city to give its attorney or other representatives an opportunity to examine the data that are to be presented before the hearing, the city will usually be ready to present its theory of the case at the hearing. As a means of facilitating the disposition of cases, therefore, it is wise for the company applying for a change in rates to discuss the proposed changes and the company's reasons for believing them justifiable with the city officials before the first hearing before the Commission. No harm can be done by being frank.

Company Should Prepare Its Own Case.

It is true that the Commission has a more or less complete mechanism for the ascertainment of the facts in any inquiry it may be called upon to make. This is necessary in order that the evidence introduced in a case before it may be tested out by subsequent independent investigation and that accounting and engineering assistance may be rendered utilities and municipalities operating utilities. It is taking an advantage of the Commission, however, for a utility to presume that the possession of a staff of engineers, accountants and investigators renders the Commission an available agency for the investigation of the utility's affairs when the utility feels itself in need of aid in the way of higher rates or relief from service requirements. The utility, having full access to its own books, records and accounts, should prepare itself, before seeking relief, to draw its own conclusions as to its needs and the reasons therefor, and be in a position to convince the Commission of the fairness of its cause.

The Value of Graphic Instruments in Improving Motor Drive

Graphic Wattmeters Permit Detail Study and Improved Operation of Motors in Large California Cement Plant

By T. S. MONTGOMERY and W. B. BRAY

Superintendent and Chief Electrician, Respectively, of Pacific Portland Cement Company, Consolidated.

THE plant of the Pacific Portland Cement Company, Consolidated, is located at Cement, Solano County, Cal., and is operated entirely by electric power. This power is developed hydroelectrically in the Sierra Nevada Mountains, conveyed by long-distance transmission to the plant at a voltage of 60,000 and reduced at a substation on the company's property to 2080 volts. This voltage is maintained on all motors of the company above 20 horsepower. Motors of 20 horsepower and less are run with 440 and 110 volts. Naturally, because buying our power, we are well equipped with recording wattmeters and voltmeters for a study of the general load conditions.

A few years ago we began to realize that, in order to keep abreast with competition, it would not do for us to be satisfied with good average production, but that we must strive to secure maximum production from each individual machine in our plant. Considering the fact that we have several different types of machinery, this was quite a problem, and the first thing we considered necessary was to study carefully the capabilities of each machine, ascertaining its good points and its bad points.

As the machines are driven electrically, we decided to obtain a recording instrument, which could be attached to each motor, and the working conditions recorded. After investigating several types of instruments, we finally bought an Esterline graphic meter. We were first confronted with the problem of a large number of individual motors with varying voltage, and in order to transport the testing instruments easily, we devised a portable test board, which we believe the accompanying illustrations explain for themselves. For 440-volt motors, we used a board equipped with one polyphase integrating wattmeter and the graphic meter. The front of this board is shown in Fig. 1, and the back of it in Fig. 2. In the space above the graphic instrument you will notice space reserved for ammeters. Fig. 3 is the 2000-volt board, equipped with ammeters and watt-hour meters. Fig. 4 shows the

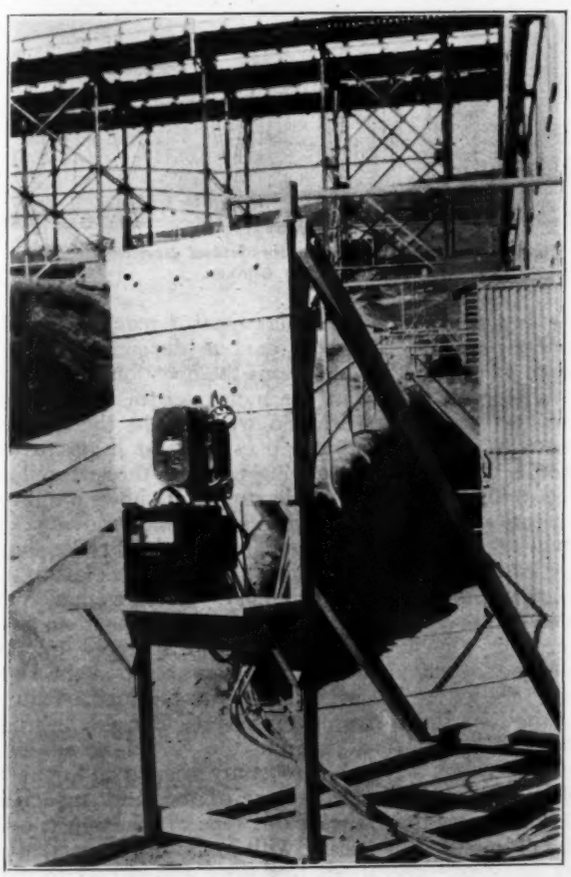


Fig. 1.—Front View of 440-Volt Test Board.

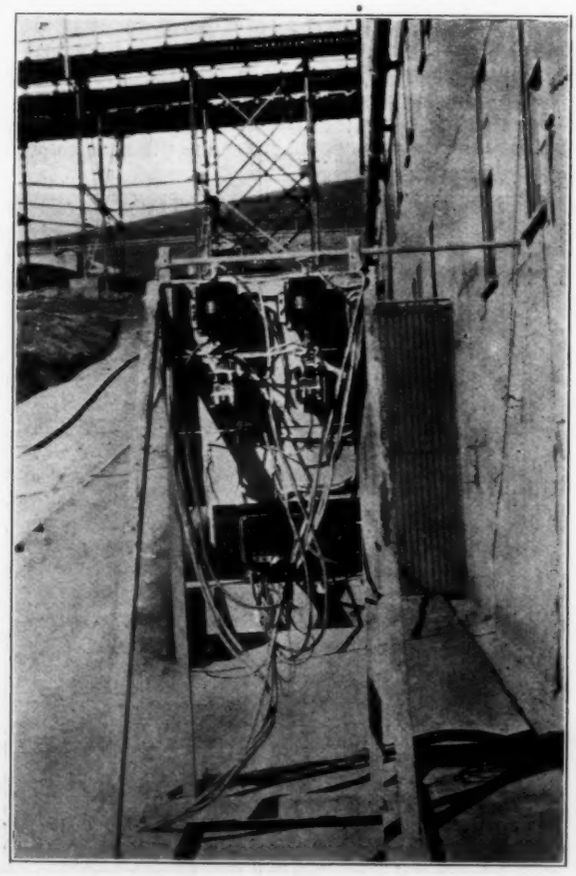


Fig. 2.—Rear View of 440-Volt Test Board.

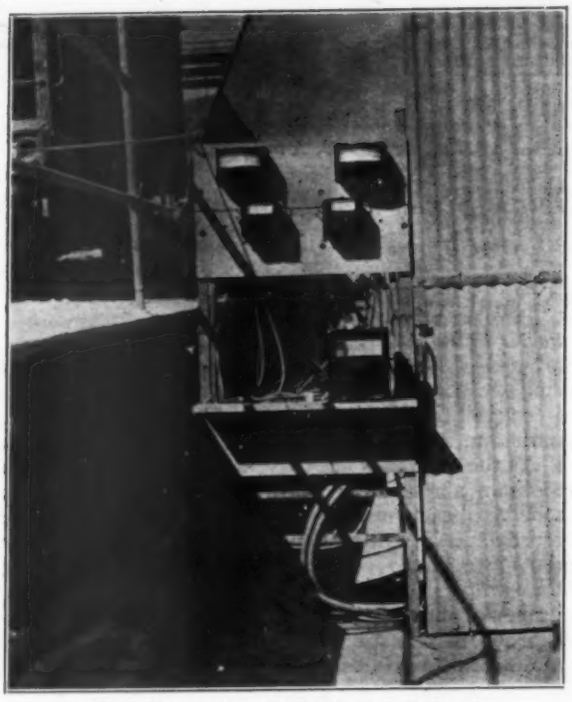


Fig. 3.—Front View of 2000-Volt Test Board.

back of this board. This arrangement we found most convenient, easy to handle and, once equipped, convenient for all our testing problems. The insulation in this board is of 2000-volt special wire, reinforced with circular loom.

We would set the board up on a particular machine and allow it to run for several days, the electrical department, of course, keeping close watch upon it. If we found that conditions were normal, and the load was uniform, it was then taken away and placed upon another motor. For the convenience of the executives of the company who would not have the time to study

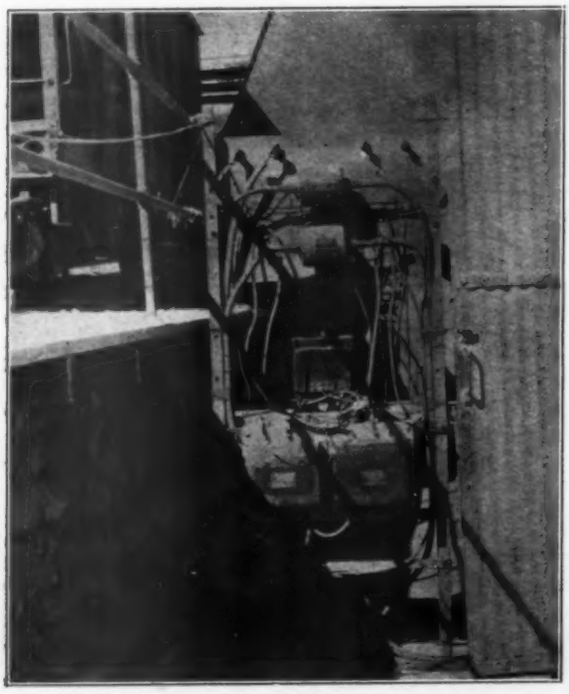


Fig. 4.—Rear View of 2000-Volt Test Board.

the daily charts, we adopted the method of reproducing portions of the charts on co-ordinate paper somewhat as shown in Fig. 8. By this means we were enabled to present graphically the entire story, in a condensed form, and brought to a busy executive's mind a picture of the operation of the machine, showing the good and bad points of individual operation.

Our work has extended over a period of many months and we have charted practically all of our motors. We have picked at random three cards, which have been of special help to us and which show strikingly the value of a graphic recording instrument.

Test of Clinker-Crane Motor.

We use for the storing of our clinker a derrick crane made by the American Hoist & Derrick Company, St. Paul, Minn. This crane is 100 feet high, has a boom 80 feet long, and a 1½-yard bucket. The duties of this crane are to pick up fresh clinker coming from the kilns, raise and deposit it in designated piles, slew back empty, and then pick up aged clinker, carry it to a storage bin, deposit it, and slew back to the fresh clinker pile again. Part of this operation is shown by the view in Fig. 5. As this company was

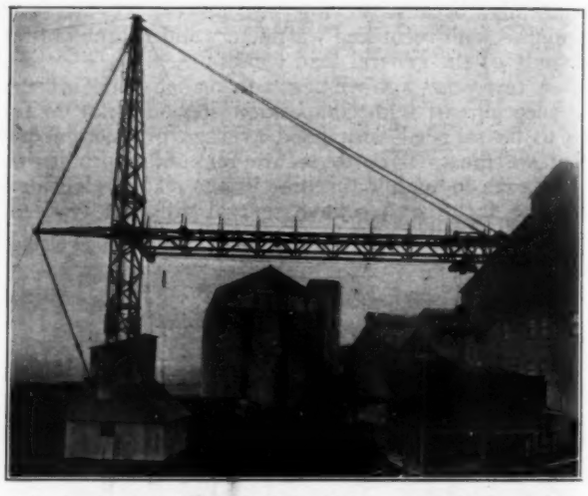


Fig. 5.—General View of Motor-Driven Derrick Crane for Handling Clinker.

the first to use this particular type of machine in this kind of work, we had no data to depend upon, and when we first began operations the question was raised as to the sufficiency of the motor on this installation for the work given it. So we brought the graphic recording instrument into play, hooked it up to the motor, and the accompanying chart at the left end of Fig. 6 plainly tells the whole story. It shows the three operations—hoisting, slewing and trolley moving. It shows the maximum momentary peak load to be about 45 kilowatts and also shows that it takes about 10 kilowatts to run the crane empty. After we had completed the work, we speeded the instrument up to a feed of 3 inches per minute, and analyzed by this means the individual peak loads, as shown at the right end of Fig. 6. To us, this is a most valuable feature of the Esterline instrument; we were first able to study the entire operation, pick out the varying conditions, and then we were able to study these conditions at close range. This one feature of the work especially demonstrates the value of this type of instrument over the old method of testing with individual meters, with its numerous operations to record and curves to plot, all with great likelihood of error. While integrating

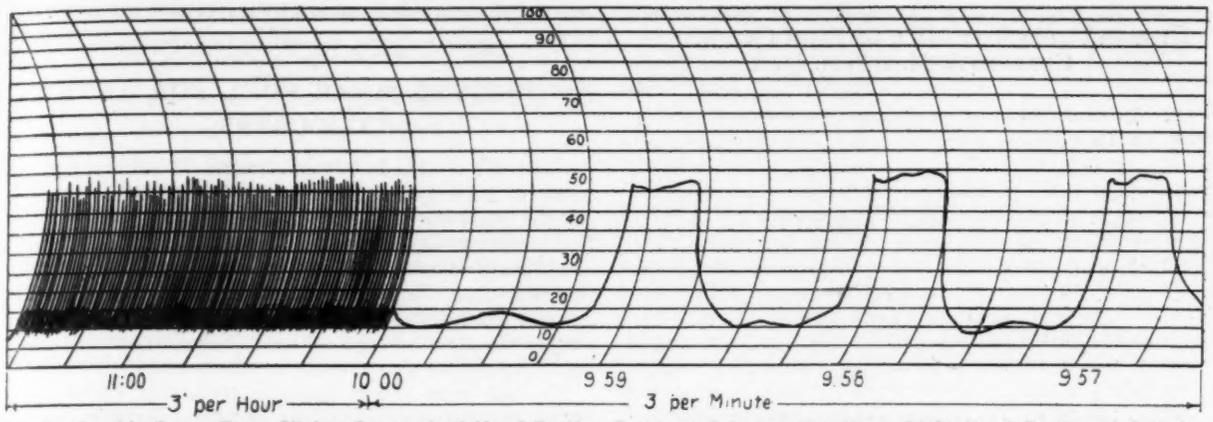


Fig. 6.—Graphic Curve From Clinker Crane. Left-Hand Portion Taken at 3 Inches Per Hour—Right-Hand Portion at 3 Inches Per Minute. This Record Shows Advantage of the Minute Chart-Feed Attachment in Obtaining the Characteristics of the Load on an Electric Motor.

meters record the total energy consumed in a certain time, they do not give detailed information relative to the variations of load in that time, and these are absolutely necessary for an intelligent analysis of cost and efficiency.

The motor on this crane is a General Electric form M slipring, three-phase, 220-volt, motor, having a continuous rating of 35 horsepower at 900 revolutions per minute. The maximum rated torque is from 225 to 250 per cent of the full-load torque. The 35-horsepower rating is equivalent to $35 \times 0.746 = 26.1$ kilowatts, requiring an input of 30.7 kilowatts for a motor of 85 per cent efficiency.

The maximum momentary load on the chart is 45 kilowatts, equal to 146 per cent of full-load torque. The loss in the motor is about 4½ kilowatts. The load on the motor is figured by the crane manufacturer as follows:

20½ kilowatts for 10 seconds.
33½ kilowatts for 9 seconds.
28½ kilowatts for 5 seconds.
18½ kilowatts for 10 seconds.
11½ kilowatts for 10 seconds.
10½ kilowatts for 22 seconds.

66 seconds.

Each of these values is the average from zero load to peak.

$(20\frac{1}{4})^2 \times 10 = 4100$
$(33\frac{1}{2})^2 \times 9 = 10{,}100$
$(28\frac{1}{2})^2 \times 5 = 4060$
$(18\frac{1}{2})^2 \times 10 = 3420$
$(11\frac{1}{2})^2 \times 10 = 1320$
$(10\frac{1}{2})^2 \times 22 = 2420$

25,420

$$\frac{25{,}420}{66} = 385 \qquad \sqrt{385} = 19.7$$

The derrick would therefore use 19.7 kilowatts continuously, or 26 horsepower, and as the motor is good for 35 horsepower, all arguments relative to the adequacy of the motor were settled.

Tests of Group Driving of Ball Mills.

Our mill has been operating for nearly 11 years, and when built the individual drive had not attained the popularity that it now enjoys. For our preliminary raw grinding we have an installation consisting of one General Electric 300-horsepower, 2080-volt, three-phase, 60-cycle motor, running at 515 revolutions per minute and driving six No. 8 Krupp ball mills. In recent years the practice of such group driving has been questioned, and in order to learn just what was happening, we studied the installation by means of the graphic recording instrument. Fig. 7 is a portion of a chart showing 24 hours' operation of this installation. A study of this chart will prove that good efficiency was obtained and that the installation as a whole was working satisfactorily, although from a standpoint of ball-mill hours individual driving is to be recommended.

The following table gives in condensed tabular form the record from the full 24 hours' graphic chart, part of which is shown in Fig. 7. This shows that 5 hours 40 minutes total time was lost in this particular 24-hour day. This record was carefully followed up and the causes of the various shutdowns ascertained for the purpose of eliminating them as far as possible. By this means the operation of the mill was materially improved and production decidedly increased.

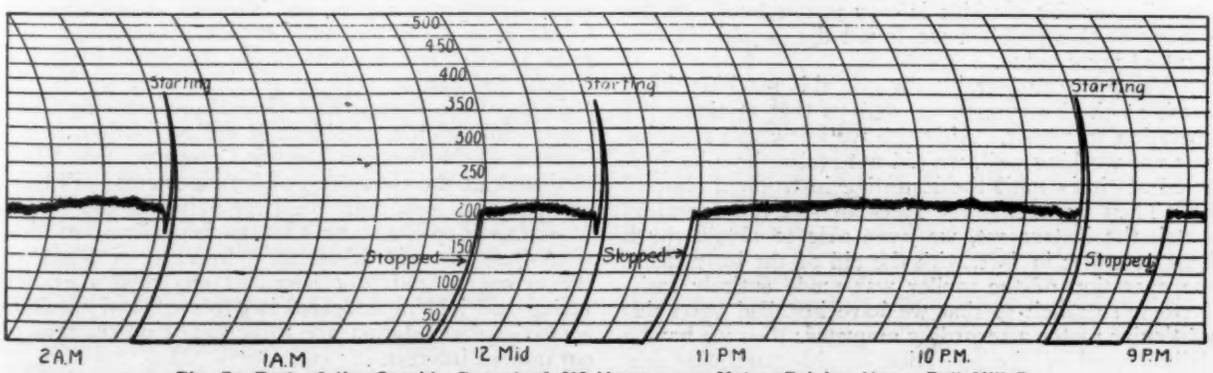


Fig. 7.—Part of the Graphic Record of 300-Horsepower Motor Driving Upper Ball Mill B.

CONDENSED RECORD OF A DAY'S RUN OF 300-HORSE-POWER UPPER BALL MILL B. FROM GRAPHIC CHART, 6 A. M. TO 6 A. M.

		Time Lost.
Start	7:00 a. m.	1 00
Stop	1:10 p. m.	
Start	2:05 p. m.	55
Stop	4:30 p m.	
Start	4:35 p. m.	05
Stop	6:00 p. m.	
Start	7:00 p. m.	1 00
Stop	9:05 p. m.	
Start	9:25 p. m.	20
Stop	11:15 p. m.	
Start	11:40 p. m.	25
Stop	12:15 a. m.	
Start	1:40 a. m.	1 25
Stop	5:10 a. m.	
Start	5:40 a. m.	30
Total time lost		5 40

Fig. 8 is redrawn from a special test chart and shows a study of the installation on shutting off each mill consecutively after starting with full load, and getting down to friction load, then again starting up

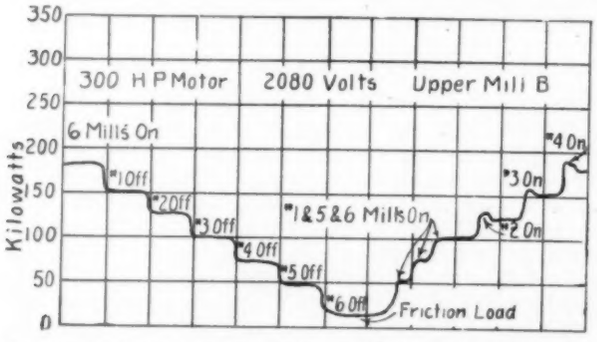


Fig. 8.—Graphic Record of Test Showing Load for Each Mill, On and Off, Also Friction Load.

each mill separately. You will note that the starting load and running load is plainly shown, as well as the friction load.

IMPROVING THE OPERATION OF A CLAY MULLER.

Each cement mill has its own individual problems, due chiefly to the fact that no two mills are working under exactly the same condition. For the grinding of our dry clay we use a tool known as a clay muller. For satisfactory operation, this machine requires considerable personal attention, and we have known for some time that its personal equation was high and that poor results were often obtained through lack of proper attention, as this machine is easy to overload. In the solving of this problem we found the graphic instrument of great value.

We spent considerable time on this machine, inasmuch as the instrument showed us that at times the operation was poor. Although we knew this machine was not working well, we did not realize how badly it acted at times until the Esterline instrument showed us. Then by having the foreman and the operators watch the instrument, we were able to obtain much better results; in fact, with the aid of the instrument, the operation of the muller was made entirely satisfactory, so much so that we have installed upon this particular motor a recording ammeter; thus we have a daily record of the operation of this particular machine and the old troubles of yesterday are passing away.

BRIQUETTES MAKE FUEL FOR ANTHRACITE USERS.

The U. S. Fuel Administration is taking up the question of briquettes as a possible means of increasing the anthracite supply of coal for next winter. The Conservation Department of the U. S. Fuel Administration in Washington has the matter in hand but, in the meantime, the anthracite producers are giving their earnest attention to the matter of increasing the fuel supply through salvage of coal fragments which have been slushed away from the breakers and lost.

It has been found possible to utilize such waste anthracite by manufacturing it into briquettes which make perfectly good and effective fuel. On a small scale, this has been done with success, and it is now the thought to develop the briquette as a by-product of the anthracite industry in a larger way. Last year the Lehigh Coal & Navigation Company produced 30,000 tons of briquettes, composed of coal fragments the size of pinheads and bound together with tar and compressed into solid lumps by high pressure. Briquettes burn to excellent advantage in furnaces, ranges and open-grate fires. As made, they average about the size of nut coal.

Much of the anthracite refuse which is now swept down the streams and rivers of Pennsylvania is carbon, but until very recently there was no way to conserve coal so lost to economic usage. In the development of the anthracite industry and the progress made in all directions, it has been found possible to salvage more and more coal which formerly was wasted.

Improved mining appliances and methods enable proportionately more of the anthracite in the ground to be taken out than in the old days. This is a gain in conservation of a valuable natural resource. Under the old methods and before the breakers were highly perfected as they now are, a great deal of anthracite was, of necessity, discarded. Hence the huge culm banks of the past, which now are being washed over through washeries, are yielding a large amount of coal in every way as good as freshly mined anthracite.

Salvage of the coal now lost in the slush washed away from the breakers will be, as it were, the last word in getting and making of commercial use all that is taken from the anthracite mines that will burn.

NATIONAL ELECTRICAL CREDIT ASSOCIATION TO MEET IN CHICAGO.

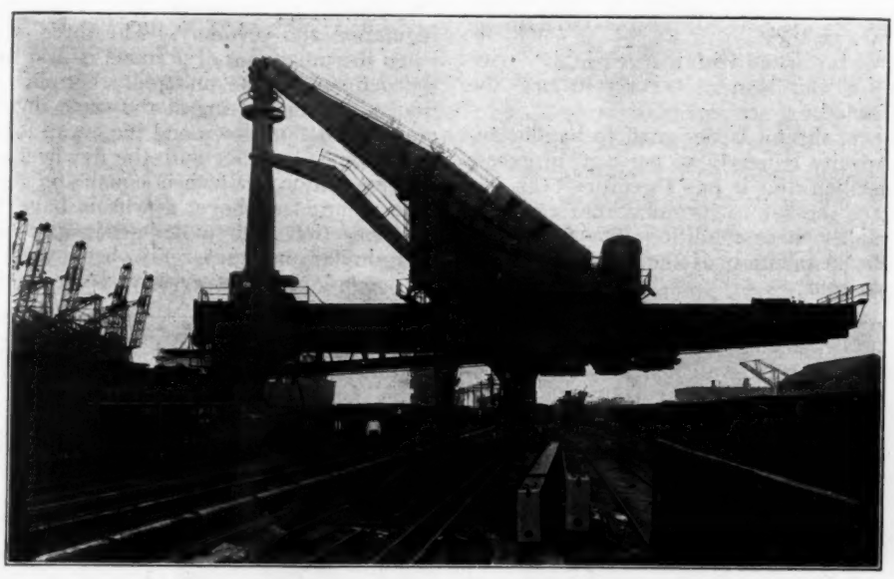
The National Electrical Credit Association will hold its nineteenth annual meeting at the Hotel La Salle, Chicago, on June 17 and 18; and the twenty-third annual meeting of the National Association of Credit Men is set for June 18 to 21, inclusive, at the same place. The sessions of the National Electrical Credit Association will be presided over by W. T. Pringle, of the Pringle Electrical Manufacturing Company, Philadelphia, president of the association. M. A. Curran, of the Western Electric Company, New York, chairman of the committee of arrangements, will have charge of the program. H. E. Wilkins, of the Belden Manufacturing Company, Chicago, is chairman of local committee on entertainment. Presence of many of the managers and proprietors of electrical manufacturing and jobbing concerns is expected, and speakers of national reputation are to be heard on matters of paramount interest.

FLYWHEEL EQUALIZING GENERATOR IS ECONOMICAL FOR ORE DOCK.

Permits Shutting Down One of Three Generating Units Although Load Was Doubled.

A generator of high mechanical inertia floated on a line with rapidly fluctuating load will serve to smooth out the load irregularities, especially when equipped with a flywheel of proper design. For many years this type of unit has been known and utilized not infrequently in stations supplying heavy and rapidly changing industrial loads. An instance of the marked economies that may result from the use of such a flywheel equalizing generator has recently come to our notice that is worth recording.

The problem as presented to the engineers was approximately as follows. The Erie Dock Company, Cleveland, Ohio, owned by the Erie Railroad Company, was operating on its ore dock four Brown electric unloaders each of 5-ton capacity. On account of the peak loads, the generating equipment, consisting of three 350-kilowatt direct-current engine-driven generators, was at times operating under heavy overloads. The company was preparing to add a 17½-ton Hulett unloader, thus nearly doubling the unloading capacity of the dock. Engineers of the Allis-Chalmers Manufacturing Company were asked to go over the situation and make recommendations as to whether additional power equipment or a flywheel generator set should be installed.



Hulett Electrically Operated Ore Unloader. Capacity 17½ Tons.

Taking load curves with the small unloaders in operation and estimating for the new Hulett unloader, the engineers recommended a flywheel equalizing set as not only the most economical in first cost but also the most satisfactory and economical in operation.

The Erie Dock Company, after the contract was let on this basis, decided to have the set made of such increased capacity as to take care of a second Hulett unloader, which it expected to add later. The set was therefore designed and built to handle the peak loads for six unloaders—the four 5-ton Brown unloaders then installed, the 17½-ton Hulett being installed, and a second Hulett to be added later.

Briefly stated, the operation of the set is as follows: In starting and during intervals of light load the machine operates as a motor, on current taken from the power station, and stores energy in the flywheel. During peak loads the machine is driven by the flywheel and, acting as a generator, supplies power to the system, thus relieving the power station of the peak loads. The flywheel of course only absorbs or gives up its energy through an increase or reduction in speed. The control equipment for accomplishing this is more completely described below.

The flywheel set consists of a direct-current, interpole, compensated, compound-wound machine, direct-connected to a flywheel and mounted on a common cast-iron base, with three pedestal bearings, as shown in one of the accompanying illustrations.

The machine was designed to take care of maximum peaks of 1000 kilowatts for periods of 18½ seconds. This output is within the range of the machine itself, the set having an initial speed at the beginning of the period of 720 revolutions per minute, and at the end of the period approximately 580 revolutions per minute.

The generator has a normal rating of 500 kilowatts, 250 volts, 600 revolutions per minute, and will carry momentary peak loads of 1500 kilowatts or 6000 amperes at 250 volts.

The flywheel, which weighs approximately 30,000 pounds and is 9 feet 6 inches in diameter, is built up of steel plate disks machined to 1¾-inch thickness, riveted together and mounted on the shaft. The wheel was built up in this way in preference to using a steel casting on account of the greater strength and more homogeneous material which could thus be secured. The flywheel runs inside a sheet-metal casing to reduce windage and friction.

The set is furnished with special automatic starting and control apparatus. The necessary switches and contactors are mounted on suitable panels. Resistance is mounted separately above the panels. The controller and starter are designed to automatically start up the set on closing the main switches. These switches are so arranged that it is possible to disconnect the flywheel set from the line.

The unit is designed to float normally on the line, and under normal conditions it will take energy from the main line and store it in the flywheel. When the ore hoists are in operation and taking from the line in excess of 5000 amperes, the machine acts as a generator and delivers excess power to the motor load, thereby keeping the load on the station approximately constant. These results are obtained by means of the relays and resistance connected in series with the shunt field.

When the load current exceeds the value for which the main series relay is set, it will act and cause the series field of the generator to be cut in. This causes the generator to supply current to the line. As the speed decreases the relays controlling the field resist-

ance will automatically keep up the voltage, as follows:

Relay No. 1 is designed for approximately constant line current, and when the line current exceeds the average for which the relay is set, the latter operates and cuts out part of the resistance in the shunt field, thereby raising the voltage of the machine and making the flywheel set act as a generator to take the excess current. The speed of the set will then drop and, if the peak load does not pass off the line, the current will begin to increase and the second relay (set for a slightly higher current than No. 1) will operate, thus further strengthening the field of the generator and again causing it to take up the excess current.

With a reduction in speed from 720 to 580 revolutions per minute the flywheel set will deliver to the system the equivalent of 18,500 kilowatt-seconds and is thus capable of delivering 1000 kilowatts for 18½ seconds or 1500 kilowatts momentarily.

In case of power failure the set is brought to a stop by means of dynamic braking. The relays handle the shunt-field circuit in such a way that the field is strengthened gradually, so as to prevent the sudden shock which would reseult in case full dynamic braking was applied at one time.

The machine is furnished with a speed-limit device which will cause a shutdown of the set in case the overspeed is exceeded.

As stated above, the set is designed to handle unloaders whose capacity is nearly 50 per cent in excess of those now installed and it has therefore been impossible to operate the set to its maximum capacity. However, even under these conditions the results before and after the installation of the set afford some interesting comparisons.

Load curves taken before and after the installation of the flywheel set show a very considerable reduction in the peaks but it has not been possible so far to obtain such curves when all the unloaders were operating at the same time. On comparing the two curves referred to it was found that the average loads in both cases are practically the same, around 650 kilowatts. The maximum peak before the flywheel set was installed was 5100 amperes, while in the later curve the maximum runs from 3000 to 3800 amperes, but the 3800-ampere peak occurs only twice in the whole record. The set is now operating at only about one-third load, which is not sufficient to cause the shunt relays to operate as these cannot have close adjustment for both light and heavy loads. With a greater load so that the shunt relays can operate or with the set loaded up to its capacity, a much smoother curve will be obtained.

Previously it required three generating units, each of 350 kilowatts capacity, to operate the four small unloaders, and even then the generators were operating at times under very heavy overloads, with poor economy and very poor regulation. Since the introduction of the flywheel set, two engine sets carry nearly double the capacity in unloaders and with greatly improved regulation and economy. The three engines are used when the unloading of a vessel is first begun but when the demand of the unloaders becomes distributed so that all are not lifting at the same time, the third engine unit is shut down and the entire load is carried by two engines together with the flywheel set.

In addition to flywheel equalizing generators of the type mentioned above, flywheels have been employed in connection with motor-generators for mine hoists and similar purposes. Flywheels have been successfully employed in other ways for reducing peak loads.

Flywheel Equalizing Generator in Power Plant of Erie Dock Company, Cleveland, Ohio. Normal Rating, 500 Kilowatts, 250 Volts.

Editorial Comment

The Outdoor Substation

TO FIND excuse for mention, any topic today must deal directly or indirectly with the war either by bettering health and workmanship, conserving effort, time and material, or in some other way assisting the prosecution of the war until it is won. The outdoor substation, perhaps as hardly it first appears to be the case, is a fitting topic at this time. It is doing its bit, nay, its best, toward hastening the day when the war is won.

The cry has long gone out to conserve material, and capital and time. The outdoor substation does exactly these things. It is extravagant to inclose apparatus indoors, in barriers, in fireproof structures and safeguards above and around, if the same apparatus could be installed equally well outdoors without these costly complications. Every outdoor substation is a case where material has been conserved, whereas it might have been used. Material is saved, time is saved, workmanship and labor are saved, capital is saved. And everyone profits by the saving.

The outdoor substation is needed today. There are extensions to be made, whether customer or utility pays for them, and the outdoor substations usually reduce the time and cost of doing it. Before the war, and after, the outdoor substation with its low unit cost has and will again come into wide usage where the absolute minimum cost is imperative. There are many communities and other forms of load that cannot be supplied unless the construction of the tranmission line and substation are kept down to the lowest cost. There are cases where the load is but transitory, perhaps a few months or a year, and here, too, the outdoor substation of suitable design is the solution, for when the load ceases to exist the station can be moved elsewhere in toto or knocked down, with little expense to anyone.

The outdoor substation is in use today in almost every conceivable form from the type consisting of a transformer alone or with a regulator on a pole to the one occupying several acres and possessing extensive control, switching and metering arrangements, mounted on massive steel structures. Like the electric motor, there is an outdoor substation for every purpose from the one of a few to the one of many thousands of kilowatts. The purpose may be different, the arrangement may be different, and the magnitude of the installation may differ, but nevertheless the outdoor substation still has the advantage that no needless expense has been expended on useless inclosures and barriers.

Since the outdoor substation came first into use its evolution has gone steadily along. Fundamentally it was simpler than the indoor type of substation. There could afford to be more space occupied. More money could be expended on the equipment itself instead of on structural features having nothing really to do with the equipment. And so the evolution of the outdoor type substation has gone on. Difficulties with terminals and insulating bushings and waterproofing cases have been practically eliminated. Cooling either by conduction or radiation has been solved for units as large as are made today and as may be expected to be required for some time to come. The needless flexibility against all sorts of unforeseen and unlikely happenings, once a feature of many an outdoor substation, no longer exists. Every insulator and bushing is a vulnerable spot, and one that costs money as well as offering chance for trouble, hence the fewer there are the better from every aspect. Comparison with the outdoor substations of today with those of a year or two ago shows that this has been realized and unnecessary duplication and uncalled-for flexibility against unlikely possibilities no longer find general favor.

The modern outdoor substation strikes one as having a businesslike appearance, whether it be a substation serving a small load-out in some lonely rural spot or one supplying important railway traffic on one of the single-phase railroads. They are doing the work. And they are doing it in the shortest way. The wiring is straightforward and direct. Each piece of apparatus —arrester, choke coil, control and metering mechanism—is in its allotted place, electrically and physically, and in sight, the whole compact yet not cramped, conserving materials, investment and space.

In the past in many instances inattention to the possibility of having repairs made has resulted in delays in making repairs, danger to workmen and interruption to service when trouble did occur. Today, however, in large installations where apparatus is unwieldy and difficult to handle, facilities for handling and housing are usually provided. And then apparatus is more reliable now, better protected and more accessible so that, all in all, even in severe climates making repairs does not constitute a serious difficulty today; in fact, it is often much easier to make them outdoors than inside.

The outdoor substation of today is the survival of the fittest, evolved out of the years during which service, safety and economic requirements have been growing ever more severe. The National Electrical Safety Code should be adhered to always in matters pertaining to safety, and we would suggest that civic and state bodies interpret this code in the spirit instead of as has happened in some cases, opposing outdoor substations for reasons that no longer can be sustained. If universal electricity is to come, and the linking up of sys-

tems and states, the outdoor substation must play a very important part. Interstate laws should not interfere with electrification in the same way that they almost regulated the railroads out of existence. The day has gone when it was a question of whether the outdoor substation was feasible or warranted. The question today is: Cannot the substation be installed outdoors?

Guarding Against Misuse of Electricity

THE National Board of Fire Underwriters has just recently drawn attention to the fact that the class of electric heating device attaining sufficiently high temperatures to cause combustion and ignition of adjacent objects and materials is becoming responsible for an increasing number of fires. Once a heating device has accomplished its purpose it should not be left turned on. To do so is to abuse the device, for it may damage itself; it is uneconomical, since energy is uselessly expended; it is foolhardy, because the overheating may cause fires or at least damage by smouldering. These devices should not therefore be allowed to remain in close proximity and in actual contact with inflammable objects and materials; for example the electric toaster should not be placed where the window curtain can blow against it and catch afire, or even scorch, the hair curler ought not to be laid upon the flimsy dresser scarf, and the flat iron left upon the ironing board with current on surely causes damage to the board, ruination to the material under it, and probably a fire.

These facts are, of course, all of them obvious—the waste of money, the risk of fire and destruction of the device itself and surrounding objects—and apply with equal truth to any appliance of any kind that attains a temperature above a definite limit irrespective of how that heat is made. And yet these same obvious things are being done every day, and many times a day.

To reduce the fire risk resulting from careless and thoughtless use of electrical heating appliances requires immediate and deliberate action in a way that will be productive of widespread results. That the matter is a serious one cannot be ignored. That means must be found to combat it will be realized when it is mentioned that the Acturial Bureau of the National Board of Fire Underwriters reports some 100 fires a day result from the careless use or misuse of electricity and current-consuming devices of the so-called heating variety. Each individual fire is of small loss it is true, but in the aggregate the loss is enormous. Recent statistics from the same source show that electricity is responsible for the second largest payment by insurance companies for fire loss, the financial loss in 1916 being $16,500,000 from this cause.

This will not do. Something must be done, in protecting devices that are so easily used, as readily abused. As has been pointed out, the vast majority of fires from things electrical are due not to defects inherent to the devices but to the persons using them. It is carelessness that comes of ignorance, inexperience, thoughtlessness and from lack of commonsense that is to blame. It is to overcome this carelessness by preaching safety and economy, by educating and enlightening, that the chief effort must be made; and perhaps the most thorough and efficient way to do this is for each and every central-station company to teach its customers. But in drawing attention to the risk of fire from electric heating appliances it is not desirable to arouse mistrust, suspicion and fear, for to do so would largely tend to defeat the purpose of the electric heating device. The object is to educate, to awake realization of the latent dangers due to careless handling of the silent invisible properties of electricity and its ease and often remote control—out of sight, out of mind applies forcibly to the electric heating device.

Point out the ease of abuse, rouse the spirit of carefulness, create caution and the menace of the electric heating device will largely vanish. Tell your customers in a language they understand, in a way that will bring home to them the importance of carefulness. Remember the less alert, the less experienced, the less educated the users of electricity the greater the need for a campaign that should really not be needed at all. Tell those that need telling to remember not to forget to turn off the switch when heat is no longer required; to prevent inflammable materials from coming into close contact with the appliances while hot, unless they are being watched; to keep the hot device away from actual contact with combustible materials. All that is necessary is to arouse sufficient appreciation or selfish interest to make possible thereafter the small amount of mental exertion to be careful, or anyway prevent thoughtlessness.

There are many ways of telling your customers these things it is best they know, best for you that they should know. But however it is done, whether by advertisements, by slips enclosed with the light bills, or even upon the bill itself, it should be done soon. And it should be done fairly often. Perhaps one of the surest methods of approach and most promising of results is through the pocketbook, for humanity is particularly susceptible to pecuniary influences. Explain that whether abuse of electric heating devices causes damage to the device itself or other objects may be in doubt, there is not a bit of doubt about the waste of energy and money that pays for it, if the device is left turned on when not needed. Perhaps it is easier to remember to practice economy of money for wasted energy, though usually the smallest item where a conflagration ensues, than to practice care and safety for safety's sake. However, tackle your customers through their thrifty or cautious instincts or as seems best. But tackle them now.

The Fire Underwriters are vitally concerned with reducing fires, it matters not how caused. The electrical industry is no less vitally concerned in increasing the use and preventing the abuse of electricity. The public must be taught. The electrical industry can best do the teaching. Otherwise the Fire Underwriters will do it.

Week's Events

Fire Hazards of Electricity—Decision of Supreme Court on the Resale Price of Patented Articles—Other News

POWER AND HEATING DISCUSSED BY OHIO CENTRAL STATIONS.

Electric Brass Melting and Chain Drives Two Topics Considered at New Business Committee Meeting.

A very exhaustive discussion of the present status of electric brass melting was one of the features of the meeting of the Ohio New Business Co-operations Committee, at Cleveland, O., on May 8. The meeting was the last one previous to the annual convention of the Ohio Electric Light Association at Cedar Point in July, and it was held under the auspices of the Industrial Power and Heating Section. F. B. Steele, power engineer of the Dayton Power & Light Company, is chairman of the Section and conducted the meeting.

Mathias Turner, of the Cleveland Electric Illuminating Company, delivered an address of welcome, following which H. M. St. John of the Commonwealth Edison Company, Chicago, presented his paper entitled, "Present Status of Electric Brass Melting."

Mr. St. John brought out the fundamental principles upon which the success of electric brass melting depends, paying particular attention to the bearing which these principles have on furnace design. He traced the development of the various furnace types proposed for electric brass melting, showing the ones which have succeeded and the ones which have failed, dependent upon the degree to which basic principles have been recognized and followed. He pointed out the financial interest which the central-station industry has in the ultimate success of the electric brass furnace, and the importance of the part which this industry can take in directing the development of electric melting along sane and rational lines.

Discussion was led by T. F. Baily, president of the Electric Furnace Company, who stated that there are 70 furnaces in commercial operation at the present day; that the product of these furnaces is better than from crucible melting; also that the labor cost is lower from the electric furnace than from the crucible type..

Mr. Crippen, of the Mahoning and Shenango Railway & Light Company, stated that customers claim a more uniform product and better sanitary conditions from the use of the electric furnace.

F. B. Steele, of the Dayton Power & Light Company, asked what percentage of increase in production is found from the use of the electric furnace.

Mr. St. John, in closing his paper, stated that on furnaces of 400 to 600-pound heats, the increased production runs from 5 to 50 per cent per man-hour over the crucible furnace, but that there is no increase in production over direct flame-oil furnaces, that at the present day furnaces larger than 1500-pound capacity are not practical to operate; that with current at one cent per kilowatt-hour (300 kilowatt-hours per ton), the electric furnace is cheaper to operate than the oil-fired furnace, the latter costing at present $3.50 to $4.00 per ton.

The noon-day luncheon of the committee was combined with members of the Electrical League. Judge Vickery, of the Common Pleas Court, gave a very stirring patriotic address.

The afternoon session was opened with a paper by Paul V. Wheeler of the Link Belt Company, on "Motor Hook-ups, the Silent Chain Drive Compared with Belts and Gears."

Mr. Wheeler brought out that the power salesman and the Link Belt salesman can combine to the advantage of both where plants are changing over to central-station service. That where high-speed motors are to be connected to slow-moving shafts, where countershafts are to be eliminated, thus saving power, the silent chain comes in to very good advantage. Silent chains connect with gear-like centers and can be used for large ratios (as high as 12:1 while gears only go as high as 5:1). Two reductions can be made by chain drive without sacrificing efficiency or compact arrangement. The silent chain is reliable, flexible, and does away with noise and gives an increased efficiency of 10 to 15 per cent.

Mr. Steele asked the maximum chain speed feasible, also the life of chains in industrial service.

Mr. Wilkinson stated that the Mt. Vernon State Tubercular Institution changed from gear to chain drive to reduce motor troubles on pumping equipment.

Mr. Ford, of the Triumph Electric Company, stated that higher speed motors can be used with chain drive, thus raising power-factor.

Mr. Wheeler, in closing, stated that the maximum chain speed without casing is 1300 to 1400 feet per minute, but that with proper lubrication 2000 feet can be attained. The life of installations is as high as 14 years. On pump installations the life is about seven years. Silent chain drive does not lend itself to high speed wood-working machinery. These require fly wheels on compressors for satisfactory service. The silent chain is especially applicable to cement and various crushing plants.

The final paper, "War Time Economies," was presented by W. A. Wolls, new-business manager, Columbus Railway & Light Company.

CHICAGO ELECTRIC VEHICLE ASSOCIATION VISITS GARAGE.

Section Officers Elected for Ensuing Year—Progress Predicted for Chicago.

The Chicago Electric Vehicle Association met on May 14, at the Fashion Garage, 5037 Cottage Grove Avenue, where the members were entertained by Harry Salvat in a way that was much appreciated. About 20 were expected, but there were between 50 and 60 present. These included most of the active members and boosters for the electric vehicle, and a few outside visitors were present, among whom were William P. Kennedy, consulting engineer, New York City.

After luncheon the chairman announced that this

was date of annual election of officers. Chairman Bower of the nominating committee presented the following nominations:

Chairman—George B. Foster, of Commonwealth Edison Company; vice chairman, Harry Salvat; secretary-treasurer, E. W. Swift.

On motion, those nominated were elected by acclamation. Mr. Foster, the newly elected chairman, responded with a speech of acceptance, and incidentally emphasized the importance of team work to make the association a success.

W. P. Kennedy, being called, spoke of the progress made by the electric trucks, passenger cars and industrial trucks in winning their way where efficient, economical service is required. Speeches were made by Messrs. Fowler, Moore and Salvat. Two pieces of vocal music were rendered, and after expressions of thanks by Mr. Salvat the members were grouped for a photograph.

LIFE AND FIRE HAZARDS OF ELECTRICITY.

Dana Pierce, Vice-President, Underwriters' Laboratories, Explains That the Loss Due to Electric Fires Is Great—Second Largest in Country.

The weekly meeting of the Electric Club-Jovian League of Chicago, held May 9, was one that will not be forgotten by those that attended. The speaker on the occasion was Dana Pierce, vice-president and electrical engineer, Underwriters' Laboratories, New York, who gave a talk on "Present-Day Electrical Tendencies." The subject matter of Mr. Pierce's address concerned the use and safeguarding of electricity in home and factory, more particularly as viewed by the Laboratories.

Great stress was laid by the speaker upon the prevention of accidents and the improvement of safety methods in the electrical field. Public opinion has changed in recent years. Inertia is giving place to action and interest. Criticism is less destructive and more constructive than formerly. The public is waking up to the benefits of co-operation. The safety first movement is one conspicuous example of this, a movement as yet in its infancy, and one that has already been enormously successful because of the interest accorded the cause by the masses.

The trend of electrical tendencies in home and factory, Mr. Pierce pointed out, has assumed two phases; one is that of grounding, the other of inclosing live parts. He pointed out how for many years the question of whether to insulate or ground fixtures had been a debated one, but there has been a gradual veering of opinion toward earthing these fixtures. He pointed out that the National Electrical Safety Code, gotten up by the Bureau of Standards, is the standard at present and advised everyone to familiarize himself with it, as it is a magnificent working standard so far as it has been able to go at present.

The difficulty of grounding portable fixtures, such as lamps, iron and hair curlers, was touched upon, and it was pointed out that there is a vast opportunity along this line for inventive genius to come into play in the development of improved fittings, methods of grounding, and protecting apparatus from abuse.

The second factor was inclosing of electrical apparatus. There is a rapid and wide movement toward inclosing current-carrying parts. Only those that have tried to inclose these parts appreciate the difficulties of doing it when considering such matters as permitting inspection, supervision and operation, the dissipation of heat, clearances. For companies like the General Electric and Westinghouse this question is a pressing one and extremely complicated, and how far to go, whether to make the inclosed parts entirely inaccessible or how much so is not easily solved. It cannot be too strongly emphasized that inclosures should be grounded permanently.

The problem of extension is a live one. New tenants and others make extensions in factory and home that are never known by insurance interests and city inspectors and in ways that defy all rules and regulations. Flexible silk and cotton-covered cords are strung along nails, underneath carpets and through holes in walls to lamps and machines without any regard to safety. These may remain for months and years until the structure burns down or there is a fire or fuse blown. This promiscuous wiring and making of extensions, unrestrained and inexcusable use of flexible cord that defies all codes, is a menace. Here, too, there is a crying need for some invention that will remove this intense hazard by making available some form of cord that will not become a hazard when abused and all laws and regulations are deliberately ignored and defied. Methods of making extensions that can be made cheaply and safely and yet do not impose a danger, require the attention of all.

The Laboratories' staff has endeavored never to make rules that will hamper or restrict the use of electricity because it believes the safest method of transmitting energy is electrically. An electric range is safer than a gasoline range; an electric lamp is safer than a kerosene lamp; an electric motor is safer than a steam engine, and so on. Electricity is the safest medium for using and transmitting energy, but energy is energy just the same. Heat is heat, whether made electrically or not, and it is failure to appreciate this fact that is responsible for many electrical fires. Few people realize what has been the result of this failure. During the last three years reliable statistics have been obtained by the Acturial Bureau of fires caused by electricity. These statistics are surprising, as is shown in the following:

Credited Cause of Fire.	Loss.
Exposure	$ 41,000,000
Electricity	16,500,000
Defective chimneys	12,750,000
Stacks	11,000,000
Spontaneous combustion	11,000,000
Lightning	8,000,000
Incendiarism	8,000,000
Sparks	7,000,000
Smoking cigarettes, etc	5,500,000
Petroleum and products	5,000,000
Total	$208,000,000

Of the enormous total loss due to fires of $208,000,000 annually, the second largest fire losses are paid for fires caused by electricity.

This is surprising, because electricity is so safe, the safest form of energy there is. It is not electricity that is responsible or is to blame; it is carelessness. The cause is because people fail to realize that heat is heat.

The many small current-consuming devices, hair curlers, flat irons, hot plates, plate warmers, and so on, are largely responsible. There are 100 fires daily from these cause—fires that often do not necessitate calling out the fire department but nevertheless require settlement by the insurance interests. These fires are

of individually small loss, but in the aggregate the loss is a large one.

Fire is the Germans' silent ally. The fire loss in the United States is seven and eight times what it is in countries like Great Britain and France. And these fires are largely due to gross carelessness, criminal inexcusable carelessness, hence largely preventable.

If there is to be improvement it will be necessary for the public to exercise more care. They must realize the situation and be made to understand that it is they that are directly responsible. The public must be enlightened on the use of electricity in the home and in the factory, and made to grasp the fact that the hazard is due to them, not to the devices. Heat is heat, however made, and electricity makes it more safely than in any other way.

Electricity needs to be safer. Some improvement can be made in methods of use, but the greatest improvement must come from the people, who must be taught to use common sense and care. This is a matter of education. If this is not done the industry will suffer and the use of electricity will be hampered and get a bad name.

Mr. Pierce then told of some of the work the Laboratories are doing in the war. Of the 150 persons on the payroll, 44 are now in government service. The standards adopted by the Underwriters' Laboratories have been widely adopted both by manufacturers and the government. The organization has acted in consulting and supervising capacities, saving time, reducing labor and enabling superior and uniform quality of materials and workmanship. In connection with government work was cited the fact that the Laboratories have passed upon more than 613,000 fire extinguishers, 213 miles of rubber hose, 270 miles of canvass hose, 14,400 lengths of iron pipe, 25 square miles of roofing, over 30,000 fireproof doors and windows, and so on.

PRICE-CUTTING PERMITTED ON PATENTED ARTICLES.

United States Supreme Court Decides Patentee Cannot Control Resale Price.

By Albert Scheible.

Both electrical manufacturers and dealers in electrical goods will be interested in a decision rendered by the Supreme Court of the United States in March and just published by the United States Patent Office, which decision terminated a long controversy between the Boston Store, of Chicago, and two of the prominent phonograph companies. The issue involved was primarily the question as to whether or not a manufacturer can use the patent laws of our country for controlling the resale price of his goods.

In this case, the Boston Store, which is one of the largest department stores in Chicago, had sold phonographs at less than the established list prices, in spite of the contract provisions regarding the maintaining of list prices as established by the Columbia Graphophone Company. This contract distinctly stated that a breach of the contract provisions as to the maintaining of prices or other conditions would constitute an infringement of the patents under which the phonographs and records were manufactured, and that the party making the contract admitted the validity of these patents and agreed not to contest the same.

In view of this contract, the Columbia Phonograph Company, together with the American Graphophone Company, for which the Columbia company is the general agent in this country, brought suit against the Boston Store to enjoin the alleged violations of the contract, basing this suit upon their rights under the patent laws. The court accordingly enjoined the Boston store, but the matter was appealed to the Supreme Court in a manner intended to force a decision on the broad question of whether or not the patent laws can be used for such a maintaining of prices.

In rendering the decision, Chief Justice White first reviewed certain earlier and somewhat related decisions. In one of these, namely, *Bobbs-Merrill Company vs. Straus,* it was settled that the copyright laws did not give the owner of the copyright the right to establish the resale price. In the case of the *Dr. Miles Medical Company vs. Park & Sons Company,* it was held that the owner of movable goods could not lawfully fix a resale price for the same, because in doing so he would at one and the same time sell the goods and still partly retain or control the same, thereby unwarrantly making his own will take the place of the law of the land in regard to such movable goods. It was also held that the power to make price limitations for the future could not be exerted consistently with the prohibitions against restraint of trade and monopoly as contained in the anti-trust law. In the case of *Henry vs. A. B. Dick Company,* relating to mimeographs and supplies for the same, it was held that the manufacturer could make his license for operating the machines sold by him under his patents conditioned upon the purchase of supplies for this machine from this same manufacturer. It was also held that the patent laws warranted the making and enforcing of such contracts. However, as pointed out by Chief Justice White, this decision was rendered with the concurrence of four members of the Court at a time when there was one vacancy on the bench and one member of the Court was absent, and the other three members dissented from the ruling.

In *Bauer vs. O'Donnell,* the Court held that patent laws could not be invoked as to the right of vending patented goods, thus confirming the general trend of the decisions rendered in the Bobbs-Merrill Company case and in the Miles Medical case. However, the question then raised was only as to the right to vend the goods, hence the Court reserved any express statement concerning the scope rendered by the patent law as to the right to use the goods. A somewhat similar decision was given in *Strauss vs. Victor Talking Machine Company,* in which it was held that the regulating of the future price or of the future marketing of a patented article was not within the monopoly granted.

After reviewing these prior decisions, the Supreme Court held that the alleged price-fixing contract was contrary to the general law and was not within the monopoly conferred by the patent law, and that the latter therefore could not properly be invoked under the guise of a patent-infringement suit for enforcing such a contract. The Court also held that no right or privilege granted by the patent laws had been violated by the price-cutting, and that a patentee cannot lawfully reserve a part of his monopoly right after delivering and receiving pay for his patented article.

Two of the members of the Court dissented from part of the ruling, while Justice Brandeis concurred in the decision as a matter of law, but expressed his belief that the entire matter of price maintenance is an economic question. In other words, he believed that the Court properly decided the matter according to our laws, but that if this decision proved harmful in its operation, remedy should be had through congressional legislation or through the Federal Trade Commission.

Commercial

Method of Eliminating Metal Fatigue—Quarry Installs Modern Electrical Equipment—Other Central-Station Items

NEW QUARRY WITH MODERN ELECTRICAL EQUIPMENT.

Crushing and Screening Plant Having a Connected Load of 800 Horsepower in Motors.

The ready market for crushed, classified stone, suitable for concrete construction and highway work, has stimulated the Lehigh Stone Company, of Kankakee, Ill., to open and equip in modern fashion a new quarry seven miles west of that city. The quarry, and crushing and screening plant have been in operation about a month.

This plant is electrically operated throughout, energy for which is supplied to the motors at 440 volts, three phase, 60 cycles, by the Public Service Company of Northern Illinois, which extended a transmission line from Kankakee to the quarry and erected an outdoor transformer. The motors are all Allis-Chalmers make, slipring type with drum control, each being belt-connected either to the machine it operates, or to a line shaft for group drive. W. R. Crawford, of Allis-Chalmers Manufacturing Company, who sold the motors, supervised their installation. These motors aggregate a connected load of nearly 800 horsepower.

The large crusher and bucket elevator served by it are operated by a 200-horsepower motor; and the secondary crushers are driven by two 100-horsepower motors, the 76-foot elevator and the rotary screens being operated by one of 75-horsepower. Conveyors, smaller screens and pumps are operated by motors of smaller sizes.

The material quarried here consists of clear, hard, white dolomite, existing in nearly horizontal strata from 5 to 8 inches thick, not accompanied by clay seams. It comes within about 2 feet of the surface, requiring no expensive stripping. The deposit, covering a considerable area, has been tested to a depth of 100 feet by diamond-core drills, by which its uniform grade was proved. The material breaks up readily, making it possible to operate the plant at high capacity and efficiency.

The present bed of the quarry grades down to 12 to 15 feet below the surface level. Blast holes, 5⅝ inches diameter and 12 to 14 feet in depth, are made by Clipper drills and the shooting of a series of holes at one time breaks a month's supply of rock for the plant. The broken rock is loaded into 4-yard Peteler side-dump cars by a Bucyrus steam shovel, and hauled to the foot of an incline over a 36-inch-gauge industrial track by a dinky locomotive, 16 such cars being in use. The loaded cars are drawn up the incline by cables attached to two motor-operated friction hoists of Power & Mining Machinery Company make, and dumped into the crusher bin, which is 20 to 30 feet above the ground level.

The initial crushing is by a No. 36 gyratory crusher, Superior type of Power & Mining manufacture, driven by an Allis-Chalmers 200-horsepower motor through belt transmission. The crusher product is carried by a 36-inch bucket elevator to a scalping screen, 60 inches diameter by 16 feet long. The material that passes the scalping screen is in marketable sizes and is carried on to bins; the reject, or oversize, from the scalper is recrushed in No. 7½ and No. 6 crushers. In the recrushing, screening and sizing that follow the scalping screen, four crushers are used—No. 7½ and No. 5 Allis-Chalmers, and two No. 6 Austins.

A belt conveyor operating below the crushers delivers the material to a Chalmers & Williams bucket elevator, 36 inches wide by 76 feet long, that stands at an angle of about 75 degrees and which discharges into a Traylor all-steel rotary screen, 60 inches diameter by 24 feet long; this is jacketed with ¼-inch wire, with 1⅛-inch square appertures, by which the undersize of 1 inch and smaller is passed and discharged upon a conveyor by which it is delivered to a second Traylor rotary screen, 48 inches in diameter and 20 feet long. The products of this system of screening consist of 1¼, 2 and 3-inch sizes from the 60-inch screen, and from fines up to 1 inch from the 48-inch screen.

To prepare pulverized limestone for agricultural purposes, 1¼-inch rock may be conveyed from one of the bins to a set of 14 by 24-inch Buchanan rolls and an Allis-Chalmers pulverizer, the crushed material, after undergoing a screening and sizing process, passing to fertilizer bins.

The 36-inch gyratory crusher, friction hoist and some other equipment were sold by O. E. Thaleg, Chicago, district manager for Power & Mining Machinery Department of Worthington Pump & Machinery Corporation.

The two large Traylor revolving screens were sold by L. J. Hewes, Chicago district manager for the Traylor Engineering & Manufacturing Company.

The plant was designed by W. R. Sanborn, of Kankakee, general manager for the Lehigh Stone Company, who has had much experience in such work. Thomas Hunt is superintendent of plant and quarry.

LOW COST OF ELECTRIC COOKING.

While electric cooking has not yet reached the stage of wide everyday usage in the United States, it has made vast strides. In Great Britain, the shortage of gas, coal and food have combined to accelerate the use of electricity as a cooking agent since the war. The use of the so-called communal kitchens, huge restaurants for public feeding, have also encouraged electric cooking, and it is, in fact, claimed this mode of cooking eventually proves cheaper than cooking any other way.

It has been stated that in Newcastle between 35,000 and 40,000 meals are being prepared weekly by means of electric cooking and at a cost of about 2 cents for between four and five meals cooked. In fact, the installation of electric cooker equipment in Newcastle has been so satisfactory from all viewpoints that plans are under way to install equipment capable of handling 200,000 meals per week instead of 40,000.

BRILLIANT RECORD MADE IN A LIBERTY LOAN CAMPAIGN.

What a Central-Station Organization Accomplished in Three Weeks.

The following is an interesting account of the methods adopted and the results attained by the Edison Electric Illuminating Company organization, Brooklyn, N. Y., in the Liberty Loan campaign which it carried on between April 15 and May 4, resulting in subscriptions aggregating $1,052,300.

Beginning the 15th of April, the entire sales force of the company was instructed to devote from four to six hours daily of the company's time in a house-to-house canvass for Liberty Loan subscriptions. The men were required to turn in daily a detailed report of the calls made, with the results. A meeting was held the first day of the campaign by the general sales agent at which time he gave final instructions, the reasons for the campaign, and suggested that every man present subscribe then and there for at least one bond. Without exception this was done, and over $3300 was signed for.

The men devoted not only four to six hours of the company's time on this work, but in many cases gave up their evenings. During noon hour the men arranged to give short talks in the factories in their districts and usually were well repaid for their efforts. Another method of obtaining subscriptions was the formation of two complete night crews for work among the amusement places, such as theaters, motion picture houses, restaurants and cabarets. Several soldiers and sailors from the Navy Yard were secured, together with two Army trucks, and each crew would start out with a definite list of places to visit. Each truck usually carried one or two good speakers. The crew would go through the house for subscriptions and in almost every case with remarkable results.

The returns from these trucks each night varied from $5000 to $40,000 each. In one case, the crew was assigned to a large dinner and "worked the house" with the result that $1,049,000 in subscriptions were secured. The Brooklyn Edison crew received credit for $400,000 of these subscriptions, the balance going to assisting committees who had representatives present.

Considerable rivalry developed between the several bureaus of the sales department, each striving to head the list on the daily report issued by the advertising manager. Right up to the very last day, the Advertising and Appliance Bureau led the race, with the Commercial Engineering Bureau a close second; but they were both pushed out of first and second places by the Williamsburgh office, which came up from fourth place and won by a margin of $4000.

The men took considerable pride in their personal record, the final report showing that W. F. Hutchinson of the Williamsburgh Office had secured $134,800, with J. E. Gutfleisch of the Bedford Office second, with $115,800, and I. T. Smith, Jr., of the Commercial Engineering Bureau third with $109,150.

The final daily report shows a grand total of 6785 subscriptions taken during the three weeks of the campaign with an aggregate subscription of $1,052,300.

On Sunday, April 14, an advertisement was run in all the Brooklyn Sunday papers, which started with this paragraph:

"With our backs to the wall, and believing in the justice of our Cause, each one of us must fight to the end." (Field Marshal Haig's order to the British Army.)

It was stated to customers that beginning April 15, the company's entire selling force would devote a certain part of the day to the canvass of Liberty Loan subscriptions and requested the customers to receive them and subscribe through them, if possible.

On May 5, the day following the close of the campaign, a second advertisement was inserted giving the final results and thanking customers and the company force for their efforts.

Brooklyn Eagle-5/5/18

$1,046,550.00

Over one million dollars—to be exact, $1,046,550.00—had been subscribed to the Third Liberty Loan in the canvass by our sales force up to last night

Unfortunately owing to our reduced force due to the inroads of the war, many of our customers were unable to be seen--but those who have been canvassed responded generously

To them and to our own force we express our appreciation We aimed at the million goal—and reached it

Tomorrow we get back to business with a Vacuum Cleaner Sale—but more of that later

EDISON ELECTRIC ILLUMINATING CO. OF BROOKLYN

Brooklyn Daily Eagle-4/14/18

To Brooklyn Edison Customers

"With our backs to the wall, and believing in the justice of our cause, each one of us must fight to the end."

Field Marshal Haig's order of yesterday to the British Army applies to us all. It is now or never!

To do our part in the fight, beginning tomorrow morning, our entire selling force will join in the Third Liberty Loan Campaign, and will make a complete canvass of all Edison Customers.

It is a work devoid of all compensation, except that which comes from the satisfaction of doing one's duty in this World Crisis.

We know Edison Customers will appreciate the spirit under which this work is undertaken, and we bespeak for our salesmen's call that reception which is best measured by results obtained.

EDISON ELECTRIC ILLUMINATING CO. OF BROOKLYN

ELECTRIC OVENS FOR CONSERVING MEAT.

In a recent publication issued in Great Britain it is stated that the use of 1000 electric ovens, each of 100 pounds capacity, would save at least 10,000 pounds of cooked meat per diem, as compared to cooking with coal or gas-fired ovens. The saving thus incident to electric cooking of meat would suffice to feed some 50,000 persons daily. The electric oven and range is finding great favor in the British communal kitchens, not for its economy of edibles alone, but because of its accurate automatic control, efficiency and general flexibility and convenience.

IRONING OUT CRACKS IN IRON.

Electrical Method of Eliminating Fatigue of Metals.

A method of renewing crystallized metal pipe is in vogue in California that is as successful as it is radical. And it is a method that should be of very real interest to all central-station companies. The method referred to is that being employed by the Bardeen Corporation at Brea, California. The method consists of heating casing, tubing and drill pipe in the oil fields electrically, or when desirable by means of other sources of heat. Electricity is the most satisfactory, efficient and in all ways superior, except in that item of cost.

Considerable pipe and metal is lost annually in the oil fields due to crystallization, becoming brittle and twisting so that it breaks. The result is loss of time and material, loss of money, since the metal is sold as junk, and reduced production of the wells while changes are being made. By the following process, known as the Bardeen process, after its inventor, Hugh A. Bardeen, junking of drill pipe may be a thing of the past, as by this process it is claimed pipe may be made over to a condition as good as new at low cost.

Steel which has been subjected to repeated shocks will break easily and the fractures show a crystalline appearance, due to repeated stresses which occur therein. The crystals are in the steel at the start and the shocks to which the steel is subjected do not form more crystals nor do they materially modify those that already exist in the steel. What happens is that as the steel is repeatedly stressed, either by bending, pulling or twisting, it becomes fatigued. This fatigue is probably merely the first stages of an infinite number of small cracks or tears in the body of the steel and these tears naturally tend to occur along the faces of the crystals of the material, at first of microscopic dimensions that do not materially weaken the metal. As they spread they greatly weaken the metal, which eventually parts along the crystal faces, and the characteristic fracture, which is referred to as crystallization, occurs.

Before this state of fatigue continues sufficiently to weaken the metal materially, or in other words if it is taken in time, it can be partly arrested by heating the material to a welding heat. But the mere heating, while it tends to stop the cracks from spreading and while it may rearrange the crystals so that some of the cracks are partly closed, is of little value unless it is done early, and in fact before much of this tearing away of the metal occurs. A badly fatigued pipe cannot be restored to its original strength by merely heating it.

The Bardeen process not only heats the pipe, but also involves the application of longitudinal pressure. In the first place, during heating the pipe has heavy spring pressure on its ends so that there is a constant pressure of about 3000 pounds on it in the direction of its length. As the pipe is heated to a carefully regulated temperature this pressure tends to squeeze the pipe together and to repair any small cracks running around the pipe. This it does just as a blacksmith makes any weld, namely, by heat and pressure. It is true that the blacksmith hammers the metal, but that is merely his way of getting pressure. In big steel mills the idea of hammering metal is gradually being done away with and large hydraulic presses are coming into very general use for forging steel. The spring pressure of the Bardeen process is an important factor, but not the most important one.

In the process electricity is used as the heating medium and, while somewhat expensive, is necessary for reasons which will be later pointed out. The first great advantage of the electric method is that each joint can be heated separately and the heat carefully controlled. In practice it requires something over fifteen minutes in which to heat a six-inch pipe twenty feet long and during the heating the operator is able at all times to observe the pipe, which rests on a flat surface and is covered with a light asbestos hood. By heating it electrically and slowly the joint is very evenly heated throughout its length and has a chance to expand slowly. As soon as the pipe reaches a desired temperature the heating operation is shut off instantly. As during the heating operation the current actually flows through the pipe and the heat is generated in the body of the pipe, this heat is evenly generated throughout the body of the metal, and as all the losses are on the outer and inner surfaces it follows that these surfaces are the cooler. Considering the pipe as a plate, it will be seen that the surfaces of the plate are cooler than the interior. It is highly probable that this unequal heating through the thickness of the material causes a working which helps to weld the cracks and arrest the fatigue. It is not this feature which makes the process a success, however, but the electromagnetic action which is taking place simultaneously.

To understand this action it must be understood that, with the very heavy current used, the magnetic effect is very marked. Large spikes will hang on the woodwork surrounding the pipe and a crowbar is pulled into the magnetic field anywhere around the pipe. This external or stray field is small as compared to that which flows through the pipe itself, however. The magnetic lines of force flow in a plane at right angles to the direction of current flow—that is, as the current flows along the pipe the magnetic lines flow around it. It is easy to calculate that the steel of the pipe is saturated with magnetism. It is, further, easy to calculate that the force exerted, which is in effect a squeezing of the pipe together, is in excess of three hundred pounds per square inch. In other words, the magnetic pull in the body of the material is at least three hundred pounds per square inch. Under this enormous pressure any cracks are "ironed out" and the material of the pipe rewelded over the cracks. Moreover, as the pipe is treated on alternating current, this magnetic pull is applied and released from eighty to one hundred times a second. As the pipe is under this pressure, which is working constantly for from fifteen to twenty minutes, it is not surprising that after being cooled it fails to show any evidence of fatigue.

Now, it will be seen that this electrical process differs from ordinary annealing in several ways.

Firstly, there is accurate temperature control. By using a pyroscope or optical pyrometer in the hands of a carefully trained man is the proper temperature at which to heat pipe to get the best results exactly obtained and not exceeded. Any such scientific and accurate control would be impossible without the use of the electric current.

Secondly, during heating the pipe is under considerable axial pressure; in fact, the pressure lengthwise on the pipe is about 600 pounds per square inch of pipe section. This longitudinal pressure is sufficient to squeeze the pipe together lengthwise and eliminate a large part of the small cracks.

Thirdly, at the same time the circulating magnetic fluxes are busy kneading the whole mass of material of the pipe and closing up and welding out any cracks which may extend lengthwise of the pipe.

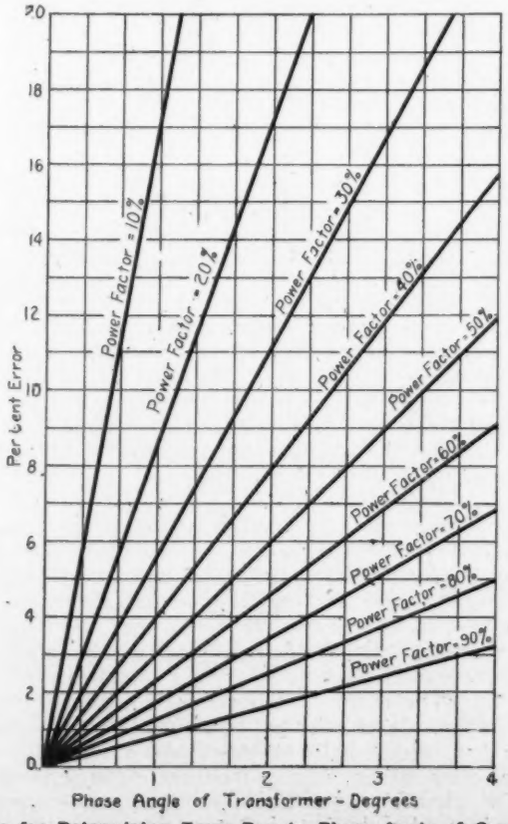
Operating

Current Transformer Phase-Angle Error—Switchboard Meter Hazard—Bare Pipe Heat Loss—Lighting Schedules

GRAPHICAL REPRESENTATION OF PHASE ANGLE ERROR OF CURRENT TRANSFORMERS.

The phase angle of a current transformer is the small angle by which the secondary current is in advance of the primary current, and as is well known, the effect of this angle is to cause an error in the indication or registration of wattmeters or watthour meters in addition to the error resulting from any error in the current ratio of the transformer. The magnitude of the phase angle error depends on the power-factor of the load; negligibly small at 100 per cent power-factor, it becomes larger and larger for lower and lower power-factors.

The percentage change in the power ratio of a current transformer due to phase angles from 0 degree to 4 degrees and at power-factors from 10 per cent to 90 per cent may be obtained from the accompanying curve. For lagging power-factors, as caused by induction motors or other inductive loads, a positive phase angle causes a decrease in the power-ratio of the current transformer. Thus, if at a given load current the transformer has a phase angle of +38 minutes, at 50 per cent power-factor lagging, as may be seen by referring to the curves, this will cause a 1.6 per cent decrease in the power ratio of the current transformer due to the phase angle only. If at some other load current the phase angle is +42 minutes, at 80 per cent power-factor lagging this will cause a 0.9 per cent decrease in ratio, while at 30 per cent power-factor it will cause a 3.8 per cent decrease in ratio. The accompanying curves are used for determining the phase angle error of current transformers in the standards laboratory, University of Wisconsin.


Per Cent Error
Phase Angle of Transformer - Degrees
Power Factor = 10%
Power Factor = 20%
Power Factor = 30%
Power Factor = 40%
Power Factor = 50%
Power Factor = 60%
Power Factor = 70%
Power Factor = 80%
Power Factor = 90%

Curve for Determining Error Due to Phase Angle of Current Transformer.

A DANGER OF 600-VOLT DIRECT-CURRENT SWITCHBOARD WATTMETERS.

By M. S. Montgomery.

For metering heavy-current railway circuits and machines at 600 volts, the Thomson type of wattmeter is almost universally used. These meters, which may have a capacity up to 10,000 amperes and even higher, are usually equipped with glass front and sides and heavy terminals and current coil which carry the main current passing through the meter. The meters are mounted as close to the circuit they measure therefore, which ordinarily means upon the switchboard, and in such locations that the conductor length is a minimum. The result is that it often happens that these meters are mounted on the front of the switchboard at the level of the operator's face.

With meters installed in such a location, the question naturally arises as to whether or not there is an element of risk attached to mounting meters in this way. The meter mechanism is entirely enclosed in glass. If a short-circuit occurred in the meter the expansion of the gases would burst the glass with an effect much like that of an explosion. If an operator happened to be passing the meter at the time the glass shattered it is extremely likely that he would be seriously injured if not actually blinded. In many cases this has actually happened. That far more accidents have not, in fact, taken place is due to good luck more than anything else.

Short-circuits may be caused by insulation failures between shunt and series coils, grounding of windings or contact between a grounded frame and the trolley side of the meter. Numerous cases are on record where these meters have blown out their glasses during thunder storms, and this has, in fact, happened so often with one large company that these meters are now treated as dangerous places during thunder storms.

That the formation of sudden and extreme pressures can be prevented to some extent by the installation of a vent to enable immediate escape of gas has been attempted by experiment, but the writer finds it very difficult to design a valve that operates with sufficient rapidity to prevent stressing the glass and at the same time not occupy space or allow dirt to enter the case. Leaving a large air space in the switchboard allows escape of the gases forming on short-circuit,

but at the same time permits dirt to enter at the rear and also makes the meter susceptible to error due to temperature changes.

A short-circuit on a 600-volt busbar with 10,000 kilowatts and more behind it is capable of doing considerable damage, even if the initial short takes place through a resistance limiting the initial current rush to a few amperes, because with 600 volts applied the cuprous gases and high voltage usually cause the short-circuit path to increase. Havoc is easily caused to station apparatus in such cases. In large stations, therefore, it is a matter that deserves careful consideration as to whether or not there is any justification for installing Thomson wattmeters for 600-volt service on the front of the switchboard on a level with the operators' face. If it is done, notice to consider such meters as hazardous during thunder storms should most certainly be posted in the stations where the practice is followed. The writer is familiar with some half-dozen cases where lightning has caused blowouts of the glass-enclosed meters.

COST OF HEAT LOSSES FROM BARE PIPES.

By W. F. Schaphorst.

Bare steam pipes have been preached against ever since the time of Watt, yet the bare pipe is still with us and losing money for its owner. Every steam pipe of any importance and size should certainly be covered unless it is a radiator pipe and is intended to radiate heat, or, unless it is an exhaust pipe or something of that sort.

Perhaps the reason why owners are so slow to cover and insulate piping is because they regard the idea as being mostly theory and that in practice the actual money loss does not amount to much.

Perhaps money loss has not been brought to the attention of the owner clearly and forcibly enough, and the reason why this has not been done is because of insufficient information on the subject, a good reliable formula that would tell quickly how much money was being lost through heat in 10 hours, or in 100 hours, has been lacking.

In the 1915 Proceedings of the American Society of Mechanical Engineers, however, is contained some good information on the subject. L. B. McMillan made some reliable and thorough tests by means of an electrical method and plotted his results in the form of a curve. His results have been used in order to develop a trustworthy formula—a formula that will handle any ordinary case of heat loss from bare pipes. Then, with the formula as the basis, the accompanying alinement chart has been gotten up. In using this chart it is not necessary to do any figuring. Simply lay a straightedge across the chart four times as indicated by the dotted lines and the cost of the heat loss is immediately found in the right-hand column.

This is the formula:

$$\text{Cost of lost heat in H hours} = \frac{(1.6 + .0056\,D)DHAC}{2000\,BE}$$

where D = the temperature difference in degrees F., or the pipe temperature minus the room temperature;
H = the number of hours during which heat is lost;
A = area of bare pipe in square feet;
C = cost of coal per ton of 2000 pounds, in dollars;
B = B. t. u. per pound of coal;
E = boiler efficiency.

For convenience, these same letters have been used to designate their various columns in the chart.

For example, take a case where

C = $3.50;
A = 100;
D = 200;
H = 200;
B = 12,000;
E = 60 per cent.

What is the cost of the lost heat?

The dotted lines drawn across the chart show how the answer—$2.64—is obtained in column Y at the extreme right.

Connect C and A with line CA and locate the intersection with column X. Then connect D and H with

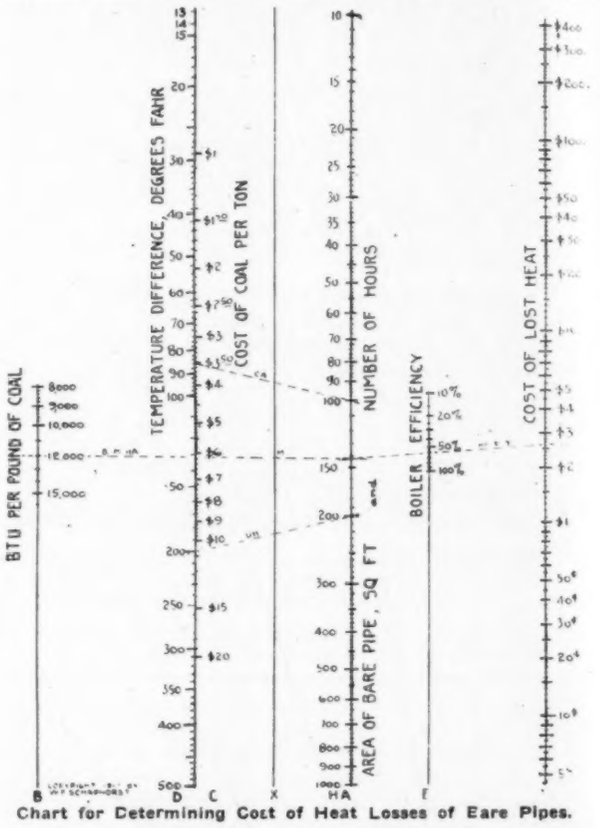


Chart for Determining Cost of Heat Losses of Bare Pipes.

line DH and locate the second intersection with column X. Now locate the mid-point M between these points of intersection and lay out the line BM HA, locating the intersection with column HA. Lastly, run a line through that point of intersection and the 60 per cent (column E)—line HA E Y on the chart—and the final intersection with column Y gives the answer, $2.64.

By following this method any ordinary problem is easily solved. If the number of hours were 2000 instead of 200, the same lines shown would be used but the decimal point would, of course, be moved one place to the right, making the cost $26.40 instead of $2.64, and if, in addition, the area were 1000 square feet instead of 100, the decimal point would be moved over one more place to the right, making the cost $264.00. The range of the chart therefore covers a wide range. It includes temperature differences from 13 to 500 degrees Fahrenheit, all heat values for coal, and a boiler efficiency range from 10 to 100 per cent.

This chart shows distinctly the money loss through bare pipes. Its aim is to influence the owner to cover those pipes. It is true that pipe covering will not save

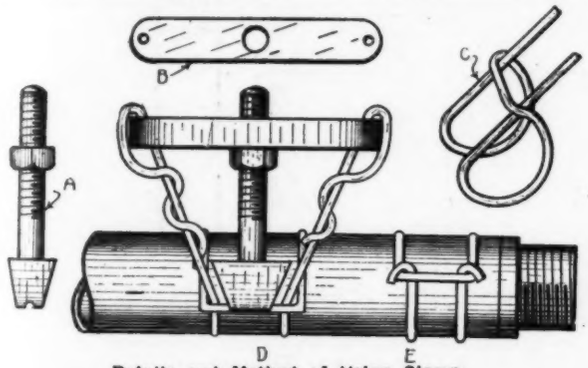
all of this money but it will save much of it. The proportion of money saved depends entirely upon the efficiency of the covering. No covering made is 100 per cent efficient, but that efficiency is closely approached.

For example, in covering the pipe whose area is 1000 square feet and which is heated for 2000 hours, if the covering has an efficiency of 80 per cent, the money saved in the 2000 hours, or 83.5 days, would be $\$264 \times 0.80 = \$211$.

A TOOL FOR CLAMPING HOSE.

By C. H. Willey.

All rubber and canvas hose deteriorates with time. With the rough usage often accorded it, deterioration is quite rapid and frequent cutting out of defective sections and splicing in new sections results. There are many instances where hose of various sorts is employed by electricians, station operators, boiler tenders and so on. Hose is used by coal handlers of small plants for wetting down the coal. It is used in the boiler room for cleaning purposes, likewise for cleaning out condensers under turbines. In the station it is used for blowing out generators, synchronous converters, transformers and the rear of switchboards and other such applications. Often the hose is treated carelessly and breaks and leaks occur.



Details and Method of Using Clamp.

The simple home-made wire binding or clamping device shown in the sketches, made from a bolt, nut and piece of 3/8-inch flat stock, is used by the writer to make quick repairs when air hose gives trouble by bursting or a coupling pulls out. This tool is very simple, yet it does first-class work and is as good as any offered on the market.

The head of a common bolt A is drawn to a wedge and a groove cut for the wire; a crosshead B is made, and the tool is ready. Loop the wire, as at C, around the hose and secure to the holes in the crosshead; put the bolt in place, as at D, and tighten the nut against the crosshead until a good strain is felt. (Be careful not to cut the hose.) Then swing the tool downwards to form the hooks, as at E; cut off the excess wire and the repair is completed.

The use of this clamp enables rapid splices to be made, and made in a way that assures a satisfactory job.

COMPRESSED AIR FOR CLEANING SWITCHBOARDS.

Compressed air is frequently employed for blowing out switchboards, and the apparatus mounted upon them. For the rear of the board a pressure between 50 and 80 pounds per square inch suffices for removing dust from conductors, oil switches, rheostats, and so forth. The nozzle of the hose should be insulated, of course, so that there is no possibility of causing short-circuits or shock to the operator.

Compressed air may also be used for the front of the board, for blowing round meters, switches, etc. However, for the front it is often considered better to use a bellows rather than high-pressure air. With a bellows it is permissible to remove the glass covers of relays and meter covers and blow gently, thus removing dust that insists on settling. The valves of overload bellow-type relays may also be cleaned in this way, at which time it is good practice to determine the workability of the relay. High-pressure air should not be used for these purposes, as meters would be damaged and there is also likelihood of dirt being blown into the valves of relays, obstructing them, and making them unworkable.

In a station there is a place for both high and low pressure air, and each should be used only in its place.

Street Lighting Schedules for June.

Every plant operating street lighting circuits must have a definite schedule for lighting and extinguishing the lamps. Below are given the two most commonly used schedules as compiled for next month. The table is compiled for latitude 40° north. Since throughout June the "day-light saving" plan of having all clocks set one hour ahead of standard time will be followed, the time given in the table (instead of being mean local or solar time, as is usually indicated in general street lighting schedules) has been advanced one hour in each case.

JUNE, 1918.

Night of June	All-Night Schedule. Light.	Extinguish.	Moonlight Schedule. Light.	Extinguish.
1	8:50	5:05	8:50	2:05
2	8:55	5:05	8:55	2:35
3	8:55	5:00	8:55	3:10
4	8:55	5:00	8:55	3:40
5	8:55	5:00	8:55	4:20
6	8:55	5:00	8:55	4:30
7	8:55	5:00	8:55	4:30
8	8:55	5:00	8:55	4:30
9	8:55	5.00	8:55	4:30
10	9:00	5:00	9:00	4:30
11	9:00	5:00	9:40	4:30
12	9:00	5.00	10:15	4:30
13	9:00	5:00	10:40	4:30
14	9:00	5:00	11:10	4:30
15	9:00	5:00	11:35	4:30
16	9:00	5:00	11:55	4:30
17	9:00	5:00	12:20	4:30
18	9:00	5:00	12:50	4:30
19	9:00	5:00	1:20	4:30
20	9:00	5:00	1:55	3:30
21	9:00	5:00	2:40	4:30
22	9:00	5:00	No light	
23	9:00	5:00	No light	
24	9:00	5:00	No light	
25	9:05	5:00	9:05	10:25
26	9:05	5:05	9:05	11:05
27	9:05	5:05	9:05	11:40
28	9:05	5:05	9:05	12.10
29	9:05	5:05	9:05	12:40
30	9:05	5:05	9:05	1:10

Tables for each month of the year, rules for the two schedules given above and for modifications of them, corrections for standard time and latitude, monthly and yearly total hours of burning for the five most common schedules, as well as other information pertinent to the subject, are printed in a booklet obtainable from the Electrical Review for 25 cents a copy.

Contracting-Construction

Croft's Final Remarks on Conduit Benders—Computing Overhead Expense—Handy Kinks—Among the Contractors

SOME COMMENTS ON CONDUIT BENDERS.

Block and Roll Benders That Are Mounted on Posts—Use of Hickey Driven in Ground.

BY TERRELL CROFT.

[This is the fourth and last of a series of articles describing different types of conduit benders and commenting on their use. These articles form a very suitable sequel to the seven articles on "Methods of Bending Conduit," by the same author, which appeared in the ELECTRICAL REVIEW *of January 12 to February 23, 1918, inclusive.]*

A Bending Rack Comprising Two Rounded Blocks Bolted on a Post is illustrated in Fig. 19. A rack of this design is often useful for conduits of the relatively large diameters. The blocks B_1 and B_2 are either spiked (or, preferably, held with lag screws or bolts) to a wooden column or post. They should, if possible, be of hard wood, such as maple. The blocks may extend from 2 to 3 inches beyond the face of the post, to prevent the pipe from slipping out of place while it is being bent. A semi-circular groove cut in

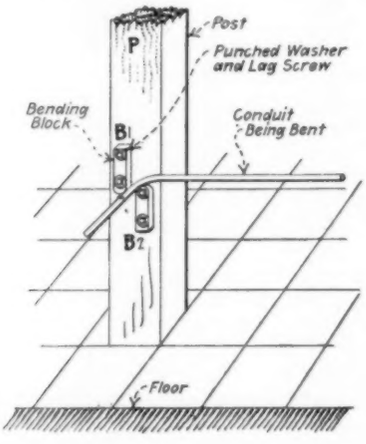


Fig. 19.—Bending Blocks Mounted on Post.

each block close to the post, so that the conduit will fit into it, will also tend to prevent such accidents. The end of each block should be rounded off as illustrated. By shifting longitudinally the position of the conduit between the blocks and bending it a certain increment in each position, the tube can readily be formed into the desired curvature.

Two Cleats Nailed to a Post May Be Used for a Bending Rack as suggested in Fig. 20, wherein the wooden cleats are shown at C_1 and C_2. The method of using this arrangement is essentially the same as that described in connection with Fig. 19. It is a good plan to permit C_1 and C_2 to extend quite a distance, even 6 or 8 inches, beyond the face of the post P, to minimize the possibility of the conduit which is being bent slipping off of them. It is also good practice to cut close to the post, a groove in each of the cleats in which the conduit may be engaged while being bent.

A Bending Rack May Be Made of a Couple of Old Wheels or Pulleys as diagrammed in Fig. 21. The wheels should be held securely to the post with

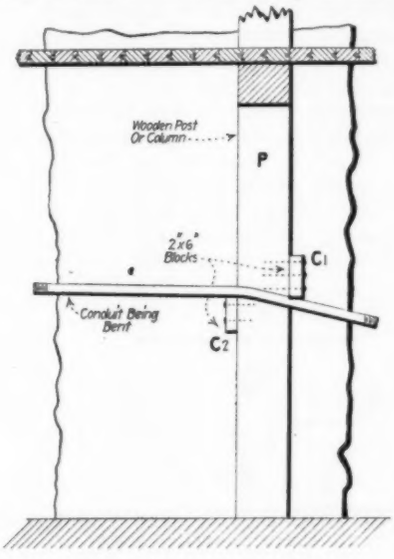


Fig. 20.—Bender Made by Nailing Two Blocks on a Wooden Column.

through bolts, if possible. The operation in bending the tube is practically the same as that described in connection with the block bender illustrated in Fig. 19. It may be desirable to set one of the wheels, W_1, lower on the post than is indicated in Fig. 21, so that the general relation of the two wheels will approximate that of the blocks B_1 and B_2 of Fig. 19.

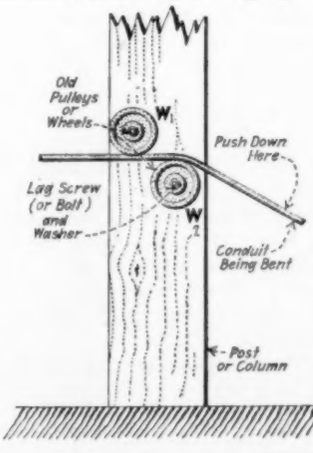


Fig. 21.—Bending Rig Comprising a Couple of Old Wheels or Pulleys Bolted to a Post.

An Inverted Pipe-Tee Hickey Bending Rack is shown in Fig. 22 and consists of a malleable-iron pipe tee (of a diameter sufficiently large to admit the con-

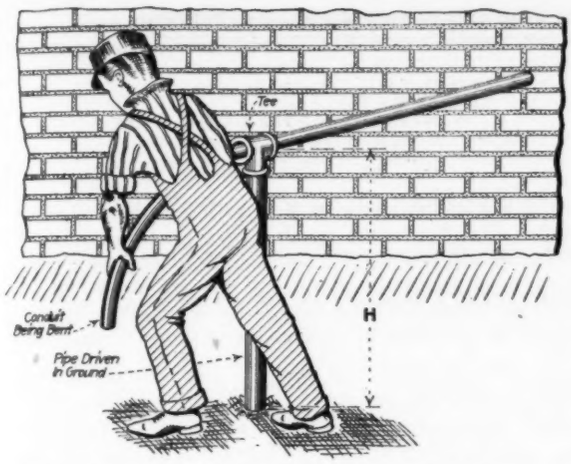


Fig. 22.—Using Pipe-Tee Hickey with Its End Driven in the Ground.

duit which is to be bent) screwed on the upper end of a piece of pipe which is held to the floor or earth. The height *H* of the tee above the surface should be such that the man, or men, doing the bending can exert maximum pressure on the extending end of the tube. Ordinarily this would be about 36 to 40 inches.

METHODS OF COMPUTING OVERHEAD EXPENSES OF ELECTRICAL CONTRACTORS.

Abstract of Address at Madison Convention Giving Three Methods as Reduced to Practice.

By Paul C. Burrill,

Secretary, Herman Andrae Electrical Company, Milwaukee, Wis.

Many articles that have appeared in the trade papers regarding overhead expense do not seem to cover the field fully and I do not pretend to be able to add anything to the volume of literature already published on the subject, but I promised to start the discussion, and believe if we each contribute some of our own experience we can apply the fruits of some of these articles to our local conditions.

No feature of our business is more important to the contractor or business getter than the subject of overhead expense. Most of us know too little about this at the beginning of the year and too much about it at the end of the year; and our present problem is to take the experience we get at the end of the year and use it at the beginning of the year, or when we are planning our business-getting campaign. No contractor should be satisfied with breaking even when managing an independent business. He should not be satisfied in making the same money that he would make if he were working for some one else on a salary. A contractor who does not make a profit above his salary would better close out his own business and take a position working for one of his competitors. In this way he will save gray hairs and worry, get more satisfaction and comfort out of life, be just as far ahead financially and have time and leisure to devote to the cultural things of life.

Overhead Expenses Defined.

We have it on no less authority than that of Mr. Goodwin, who made the statement in the Hotel Wisconsin at our January convention, that the larger contractor has a larger percentage of overhead than the smaller contractor. This I doubt very much. I do not believe there is any very great variation. I do believe, however, that overhead expense today is very much greater than it was a few years ago. Overhead expense should cover all such items as rent, telephone, manager's salary, insurance, postage, printing, automobile maintenance, office salaries, advertising, superintendents' salaries, interest, legal expense, and the proper allowance for bad accounts and for breakage or loss of material. The small contractor may think that he saves some of these items, but if he analyses matters carefully he will find that he has to pay them all in the end. If he is his own manager, he should consider the salary he would be making if doing it for someone else and should charge himself with the same salary. When all these things are taken into consideration I believe he will find his expense running between 20 per cent and 25 per cent of the sales. In discussing these problems it is customary to assume a figure of 25 per cent. This may have been right a few years ago, but we believe it should be more now.

Three Methods of Getting Overhead.

First Method.—It is a very simple matter for us at the end of the year to sit down and take our expense after the bills are all paid, figure out a percentage of overhead and determine to use it through the following year, but I believe a more careful study of the matter is needed than by simply arriving at a certain percentage. I have not seen any article suggesting any method of figuring overhead expense except to take a flat rate and apply it to all our business. This we will call the first method.

But this I object to. If we take this percentage and apply it to the sale of an attachment plug where we fiddle around 15 or 20 minutes making a connection for nothing, you are going to be very sadly in the hole. If we take this percentage and apply it to a 15-horsepower motor you are going to be beat out by some of your competitors. I do not say that it costs as much time or worry to connect the 25-cent attachment plug as it does to sell the $250 motor but I do say that the percentage of overhead should be as many times as great on one job as on the other.

Second Method.—The second method advanced for solving this problem is to have a different rate of overhead to apply to different pieces of cost. This can be illustrated by a chart covering the year's business. Now this chart gives a complicated method of figuring expense wherein you will have to use some such proportion of this:

Material	$100.00
5% overhead on material	5.00
Labor	50.00
14% overhead on labor	7.00
	$162.00
25% on general expense	32.40
	$194.40
10% profit (approximately)	20.60
Total	$215.00

This is the second method of figuring overhead expense and one that is used in most businesses, but to which I still object as it does not show the proper relation of cost between small and large jobs.

Third Method.—What I am trying to get at is that it costs a great deal more in proportion to handle the small job than it does to handle a large job. If we have a hundred $5 jobs and one $500 job, we will figure 9/10 of our time fiddling around with the little

job and 1/10 attending to the large job. I believe that the little jobs should carry many times the overhead expense that the big job carries. I do not know any way to separate this expense between the small and the large jobs in the way I have done between material and labor above.

But the truth is we are getting a higher rate of gross profits on the small job and we believe this will give us a key in the right proportion in figuring this expense. I have, accordingly, analyzed the business of a certain month and grouped together all the jobs that cost less than $1, $2, etc. You will find the same standard in all these groups, namely, that we are taking a much larger gross profit on the small job and a much smaller gross profit on the large jobs. I got still better results by taking together the entire group of jobs handled in four months, as shown in the table herewith.

No. of Jobs.	Sale.	Cost.	Average Cost.	Per Cent Gross Profit.
382	$ 409.34	$ 205.69	$ 0.54	99
380	1,236.31	649.30	1.71	90.3
201	1,632.65	907.37	4.51	79
192	3,802.53	2,325.15	12.11	63
125	5,850 82	3,905.77	31.24	50
90	7,974.21	6,322.41	70.25	26.1
51	8,194.06	6,678.58	130.95	22.6
14	4,992.47	3,942 90	281.58	26.6
13	16,816.90	13,403.45	1,031.03	25.5
1,448	$50,909.29	$38,339.81		

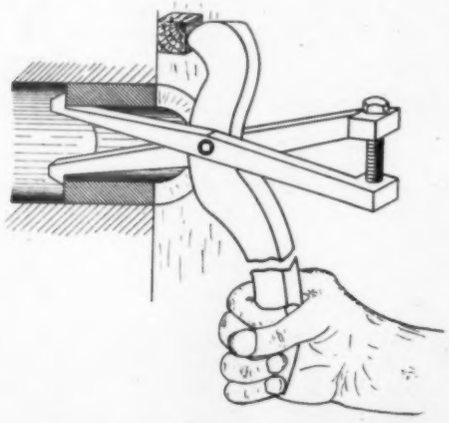
This gives a total of 1448 jobs at a total cost of about $38,000 and a total selling price of nearly $51,000. I argue that it is fair to apply our overhead expense in the same proportion as the gross profits on this group of work. If we can get some way to figure overhead expense so it follows a definite line, we will get a method which will let us put a fair price on all our work. After considerable experiment I arrived at such a line in the form of a series of steps.

The test of any such method will be if it gives enough allowance so that at the end of the year we have got our overhead expense right. I have tested this out on two or three months' business and find it gives pretty close results. I also have a series of steps for such results.

A SIMPLE BUSHING PULLER.

By Charles H. Willey.

There are numberless bushings used in the parts of the electrical machinery, engines, motors, generators, on reach rods, governor brackets, arms, rocker shafts, etc., and a bushing puller is a handy tool. The sketch herewith shows one that the writer has constructed and used to advantage. It is adjustable to a fair range of sizes and is very durable, yet easy to make. The sketch speaks for itself. A long handle is used to give leverage.

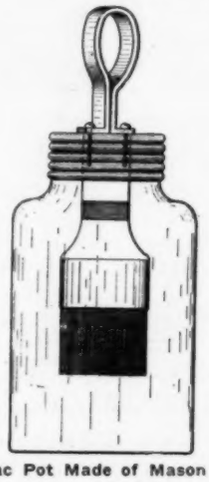


Simple But Effective Bushing Puller.

AIR-TIGHT SHELLAC POT.

By James Burns.

This kink will save lots of cussing about dried-up shellac and hardened brushes. A small quantity of shellac is always needed about motors and generators, in fact, all about the plant, and no better way of preserving the shellac and brush can be found than that shown in the sketch. Purchase a quart Mason fruit jar, one with a screw top, and cut off the shellac brush an inch or so from the brush body. Make a small loop handle of flat strap iron as shown in the sketch; drill two holes through the feet of the handle and through the cover, then with two long wood screws secure the brush to the cover, as illustrated.



Shellac Pot Made of Mason Jar.

AMONG THE CONTRACTORS.

Ellis Electric Company, Rockford, Ill., has completed the wiring of the Rockford National Bank Building. This work was done in connection with the remodeling of this concrete building. The job ran up to about $1000.

Electrical Supply Company, Madison, Wis., is installing the Couch telephone system in the new plant of the Four Lakes Ordnance Company, consisting of an automatic exchange that requires no operators. The system is considered well adapted to industrial plants. The contract amounted to $1500. Another contract just completed consisted of wiring the house, barn and other buildings of E. M. Fuller, on Monona Lake at the outskirts of Madison. The wiring was in conduit and flexible steel, and amounted to about $1000.

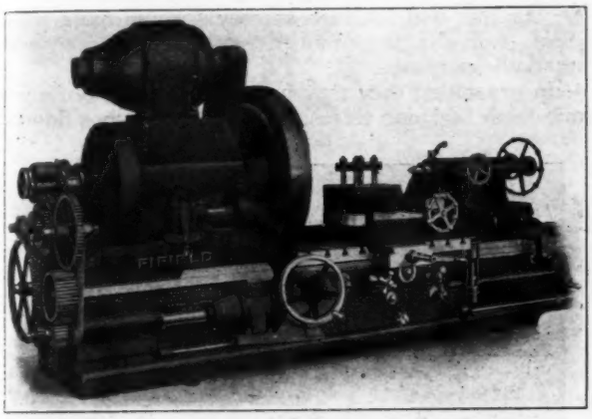
Russell & Company, 56 West 45th street, New York City, have been awarded the contract for the electrical equipment for the new addition to the Hotel Athens, 42nd street and Madison avenue, New York. This work includes the electric light and power wiring, also fire-alarm system and watchman's clock system. The addition is supplied from a private plant in the old building. Russell & Company have also received the contract for the electrical work in the premises of a Working Girls' Home, owned by the Y. W. C. A., at 159 East 104th street, New York City. The work comprises the electric light wiring throughout, but no fixtures are included.

New Appliances

Heavy-Duty Electrically Driven Lathes—Pressure Governor for Starters—Teaching the Blind How to Tape Coils

LARGE MOTOR-DRIVEN, TRIPLE-GEARED LATHES.

David A. Wright, 568 West Washington Street, Chicago, sole manufacturer of the Fifield new model, motor-driven, triple-geared engine lathes, has three shops in operation turning out these machines in various sizes to meet demands in government and private shipbuilding plants, and in other industrial plants. He has two shops in Chicago and one in Milwaukee.



Large Double Motor-Driven Lathe; Swing 96 Inches, Length of Bed 65 Feet.

The type of machine illustrated represents a new development in motor-drive for this type of lathe, which is made in eleven different sizes, from 34-inch to 96-inch swing, with any desired length of bed, requiring motors from 10 to 30 horsepower. The main driving motor, mounted at the top as shown in the illustration, transmits power to the spindle by chain belt. The motor on the carriage, for quick traverse and apron control, ranges from one to five horsepower, according to the size of the lathe. The motor drive is for constant-speed alternating or direct current, or for variable speed direct current, and three mechanical changes in head are provided.

The manufacture recently, on special order, of a lathe of 96-inch swing and 65-foot bed, for a ship building plant, gives some idea of the magnitude of some of the work being put through in this country. This type of lathe is used in shops devoted to heavy gun construction. Some of them have been shipped to France for the American base ordnance works; others are used by the Submarine Boat Corporation; and 40 are being built for the Japanese Government.

NEW PRESSURE GOVERNOR FOR GAS AND LIQUID SYSTEMS.

A new pressure governor to control standard self-starters for motor-operated pumps and compressors has been developed by the General Electric Company, Schenectady, N. Y. The governor maintains a pressure between predetermined limits on any gas or liquid systems that will not corrode the Bourdon tube.

This governor can be used on any standard alternating or direct-current circuit. It is rated for pressures of 60, 100, 160, 300 or 500 pounds and operates within settings of from 3 to 12 pounds between high and low pressures. Governors for higher pressures can be supplied if desired.

The governor consists of a Bourdon tube, an indicating needle, a graduated pressure scale, adjustable high and low-pressure stops to determine the desired pressure range, and a relay which actuates the contacts in the control circuit of the self-starter, all inclosed within a dustproof case (Fig. 1) easily opened for inspection.

Action of the governor is dependent on the Bourdon tube, which should be connected to an independent discharge pipe from the pressure tank. The free end of the tube *T* (Fig. 2) is mechanically connected to the indicator needle *N* moving it over the scale as changes of pressure affect the tube. After the settings for the pressure range have been made, the governor will automatically maintain pressure within those limits.

The operation of the pressure governor is as follows: Assuming that the pressure is at the low value, as indicated by the left-hand indicator *I*, the contact *C* on the needle *N* completes the circuit through the contact *C* on the movable arm *M*, which at the low-pressure point rests against the stop *P'*. When this contact

Fig. 1.—Pressure Governor for Gas and Liquid Systems.

is made, the circuit is completed through the relay coil *R*, causing the armature *A* to close. Attached to this is the contact *CO*, which upon closing completes the control circuit to the self-starter, causing the motor to start. The armature is also attached to the spring *S*, which holds the contact *C'* firmly against *C* until contact is broken at *P*.

As the pressure increases, the needle pointer moves

to the right, but its lower part, to which the contact *C* is attached, moves to the left and is followed by the movable arm *M*. When the high-pressure point is reached, the movable arm is prevented from traveling

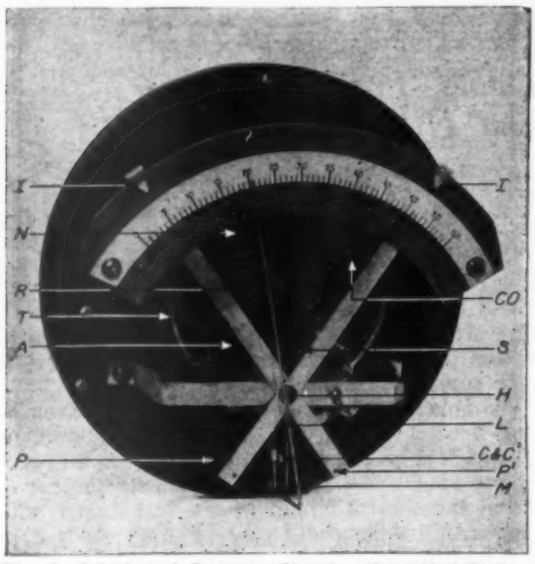


Fig. 2.—Interior of Governor Showing Operating Parts.

further by stop *P* and the needle continues its course, breaking the circuit by separating contacts *C* and *C'*. The instant the circuit is broken, the relay *R* is de-energized, its armature falls, releasing the tension on the spring *S*, and because the movable arm *M* is counterweighted it returns to the stop post *P'*.

When the pressure is decreased to the minimum value, the contact *C* again completes the relay circuit by engaging contact *C'* and the cycle of operation is repeated.

The case is tapped and drilled at the bottom for the pressure pipe and electrical conduit connections.

THE BLIND TAPING COILS.

Last fall the question of securing some help from the blind was taken up by the Westinghouse Electric

Blind Employes Taping Coils.

& Manufacturing Company with the Pennsylvania Association, a branch of which is located in Pittsburgh, and a sample lot of motor coils to be taped was sent to the Association in order that the employes might be given a chance to show what they could do. When the coils were returned, it was very evident that this work could be done in an entirely satisfactory manner by those who have been deprived of their sight. Accordingly, arrangements were made with the management of the Association to allow some of their employes to do this work, payment to be made on a piece-work basis.

As this was an entirely new line of work for them, it was decided to have a representative of the Association go to East Pittsburgh to become familiar with the work so as to be in a position to instruct those assigned to do the work. The representative selected for this training was the wife of a former Westinghouse employe, who was deprived of his sight last summer and who is now employed at the Association. She went to East Pittsburgh and was employed until such time as the management felt that she was sufficiently proficient in the taping of coils to teach the blind and to inspect their work.

At the present time, seven persons are employed and their efforts have been very satisfactory, insofar as quality is concerned. Naturally, as this is new work, the speed is not so great as with those who can see, but this will increase as they become more proficient, and also the number employed will be very materially increased.

In order that they may not suffer any loss of revenue while learning this new work, the Association is

A Blind Employe With Previous Electrical Experience.

paying them the difference between what they earned at their former employment and what their present production would entitle them to receive.

One of the employes engaged in this work shown in one of the accompanying photographs is Carrol Moore, formerly an employe of the Westinghouse Company, deprived of his sight, because of his previous familiarity with electrical apparatus, finds it easy to adapt himself to taping coils.

In addition to the new venture of coil taping, the Association also operates a broom-making department, a woman's department, formerly engaged in chair caning, which has now been abandoned in favor of coil taping.

The woman's department is engaged in weaving rag carpets, Red Cross aprons, dresses and various kinds of women's and children's wearing apparel.

Some idea of the broad scope of the organization may be obtained from the fact that last year the sales from the products of the blind employes amounted to over $40,000.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

MANCHESTER, N. H.—Manchester Traction, Light & Power Company, 46 Hanover street, has taken bids for the erection of a one-story power house addition at its plant, about 25x45 feet. F. W. Gay, Elm street, Manchester, is architect.

BELLOWS FALLS, VT.—The substation of the Rockingham plant of the Fall Mountain Company was damaged by fire recently with an estimated loss of $10,000.

CAMBRIDGE, MASS.—Cambridge Electric Company, 46 Blackstone street, has commenced the construction of the proposed one-story addition to its boiler plant on Western avenue. The structure will be about 45x65 feet, and is estimated to cost $20,000. The John F. Griffin Company, 17 Milk street, Boston, is the contractor.

CANTON, MASS.—Springdale Finishing Company has had plans prepared for the construction of a one-story brick engine plant addition at its works, about 45x50 feet in size. A. H. Wright, 53 State street, Boston, is architect.

NORWICH, CONN.—Bids have been prepared for the construction of a power house for the Eastern Connecticut Power Company, the estimated cost of which is $1,000,000. H. Pope Engineering Company, 185 Devonshire street, Boston, Mass., engineer.

PUTNAM, CONN.—Cochrane Manufacturing Company, 56 Barrett avenue, Malden, has had plans prepared for the construction of a local power house, dam and transmission system. Erastus Worthington, Dedham, Mass., is engineer for the company.

SOUTHINGTON, CONN.—Clark Brothers, Milldale, near Southington, have commenced the construction of a one-story addition to their boiler plant, about 46x51 feet, in the Milldale district. L. A. Miller, 21 Church street, Meriden, is the contractor.

ALBION, N. Y.—Western House of Refuge has awarded a contract for the construction of the proposed addition to its boiler plant. Henry C. Belson, Albion, is the contractor.

BINGHAMTON, N. Y.—Binghamton Light, Heat & Power Company has contracted with the Ansco Company for supplying electric service to its plant at Johnson City, amounting to approximately 100 horsepower in small motors.

BROOKLYN, N. Y.—Flatbush Gas Company, Clarkson street and Kingston avenue, has awarded a contract for the construction of a one-story boiler plant addition to its works, about 30x40 feet in size. John H. Deevos & Brother, 103 Park place, New York, are the contractors.

BROOKLYN, N. Y.—Arabol Manufacturing Company, 100 William street, New York, has awarded a contract for the erection of a one-story addition to its boiler plant at the local works. The structure will be about 30x40 feet. J. H. Deevos & Brother, 103 Park avenue, New York, are the contractors.

BROOKLYN, N. Y.—Clark Electric Manufacturing Company, 149 Broadway, has had plans prepared for the construction of a two-story addition to its plant at 24 Vanderbilt avenue. B. W. Dorfman, 26 Court street, Brooklyn, is architect.

BUFFALO, N. Y.—Demarest Heating Corporation is considering plans for the construction of an addition to its plant and alterations and improvements in the existing works.

BUFFALO, N. Y.—Fire, on May 5, damaged the plant of the Oldman Boiler Works, manufacturer of boilers, etc., Elk and Illinois streets, to the extent of about $20,000.

BUFFALO, N. Y.—Buffalo General Electric Company has completed the construction of new aerial lines on Hamburg Turnpike, Fillmore avenue, Lakewood avenue, Kensington avenue and Baraga street.

BUFFALO, N. Y.—The Commissioner of Public Works has submitted preliminary data to the city council covering the installation of a municipal electric-lighting plant.

BUFFALO, N. Y.—In connection with the construction of a new plant by the Buffalo Cereal Company, a one-story reinforced-concrete and steel power house will be erected, about 40x40 feet in size.

CENTRAL ISLIP, N. Y.—The State Hospital Commission, Albany, is planning for the installation of new boilers and other equipment at the Central Islip State Hospital, in connection with a new heating plant. Lewis F. Pilcher, state architect, Capitol, Albany; E. S. Elwood, secretary.

GLENS FALLS, N. Y.—Adirondack Electric Power Corporation is considering plans for the construction of an electric transformer station at Canastota. H. J. Hunsicker is chief engineer.

NEW YORK, N. Y.—Gryphon Rubber & Tire Corporation, 2541 Bailey avenue, has had plans prepared for the construction of a one-story steel transformer building, to be located on Bailey avenue, near One Hundred and Ninety-second street.

NEW YORK, N. Y.—United Electric Light & Power Company, 130 East Fifteenth street, is planning for the construction of a power station on property recently acquired at 115-119 West Ninety-seventh street.

NEW YORK, N. Y.—The Interborough Rapid Transit Company is making rapid progress in the construction of a new one-story transformer station, about 57x120 feet in size, at 150 East Fifty-seventh street. The structure is estimated to cost $45,000.

NEW YORK, N. Y.—In connection with the thirty-two story hotel to be erected on the site of the old Murray Hill Hotel, Park avenue and Fortieth street, by the B. L. M. Bates Corporation, considerable electric equipment will be required, including motors, fans, electric fixtures, and other equipment.

NEW YORK, N. Y.—The plant and property of the Submarine Wireless Company, 26 Cortland street, owned principally by titled Germans and Austrians, has been taken over by A. Mitchel Palmer, alien property custodian. The company was organized in 1912, with a capital of $500,000.

NEW YORK, N. Y.—New York Edison Company is building a one-story transformer station, about 25x45 feet in size, at 454 West Twenty-seventh street. The structure is estimated to cost $35,000.

SCHENECTADY, N. Y.—Pending settlement of their wage increase demands by the federal authorities, the 500 striking cranemen of the General Electric Company, who have been idle since April 30, returned to work on May 8. A 20 per cent increase was granted by the company with the understanding that if the federal authorities decide upon less, the difference will be refunded by the men.

SCHENECTADY, N. Y.—American Locomotive Company is having plans prepared for the construction of a one-story addition to its boiler plant, about 120x175 feet in size.

YONKERS, N. Y.—Rapid progress is being made by the National Sugar Refining Company, foot of Main street, on the construction of its boiler plant addition, brick and concrete, about 85x95 feet in size, to cost $40,000. Lynch & Larkin, 127 Downing street, Yonkers, is the contractor.

SOUTH PLAINFIELD, N. J.—Spicer Manufacturing Company is considering plans for the construction of a one-story power house addition to its plant.

BETHLEHEM, PA.—Notice has been filed with the Public Service Commission by the Bethlehem Electric Company of the issuance of bonds for $50,000 to provide for improvements, etc.

ESSINGTON, PA.—Westinghouse Electric & Manufacturing Company has entirely completed the construction of its local plant, sections of which have been in operation for some time. The property consists of 110 acres, with seven large manufacturing buildings, having a total floor area of about 35 acres. The plant will be devoted to the production of the Westinghouse-Melville-McAlpine steam turbine reduction gears and other marine power equipment.

HARRISBURG, PA.—The Harrisburg Light & Power Company has issued bonds for $50,000 to provide for improvements, extensions, etc. Notice has been filed with the Public Service Commission.

LANCASTER, PA.—Edison Electric Company has filed notice with the Public Service Commission of a bond issue of $115,000 to provide for extensions, improvements, etc.

ELWOOD CITY, PA.—Pennsylvania Power Company is said to be considering the construction of a dam at Turkey Hill, about five miles south of Wrightsville on a site now under consideration.

PHILADELPHIA, PA.—Electric Storage Battery Company has awarded a contract to William Steele & Sons Company, 30 South Fifteenth street, for the erection of the proposed one-story addition to its plant.

PHILADELPHIA, PA.—The United States Government, Washington, D. C., has had plans prepared for the construction of a two-story brick and concrete power house for the operation of its aircraft plant on League Island at the navy yards.

PHILADELPHIA, PA.—John Bromley & Sons have awarded a contract to George W. Stewart & Company, 2123 Germantown avenue, for alterations and improvements in their boiler plant at the northeast corner of Front and Dauphin streets.

PITTSBURGH, PA.—In connection with the construction of a laundry plant, the Pittsburgh Modern Laundry Company, Inc., is having plans prepared for the erection of a power plant for works operation, the entire work to cost $60,000. Paul W. Irwin, Renshaw building, Pittsburgh, is architect.

WESCOESVILLE, PA.—The Lehigh County Commissioners have had plans prepared for the construction of a one-story addition to the local boiler plant, about 20x40 feet. Tilghman Moyer, 824 Hamilton street, Allentown, is architect.

LINTHICUM HEIGHTS, MD.—Consolidated Gas & Electric Light Company, Lexington Street Building, Baltimore, has commenced the construction of its one-story local power house, about 26x40 feet. The structure will cost $7,000. The Cogswell-Koether Company, 406 Park avenue, Baltimore, is the contractor.

WASHINGTON, D. C.—A bill has been introduced by Representative Flood of Virginia, providing for the development of electric power from Niagara Falls to double its present capacity.

PARKERSBURG, W. VA.—Parkersburg Iron & Steel Company will expend $12,000 enlarging power house and purchasing electric equipment.

NORTH CENTRAL STATES.

TOLEDO, OHIO.—Bonds to the amount of $10,000 have been authorized for the purchase of fire alarm cable. Address fire chief.

YOUNGSTOWN, OHIO.—Hydraulic Gas & Power Company will increase its capital stock from $200,000 to $300,000. Extensions and improvements will be made. Address general manager.

DATES AHEAD.

Arkansas Association of Public Utility Operators. Annual convention, Arlington Hotel, Hot Springs, Ark., May 21-22-23. Secretary-Treasurer, R. B. Fowles, Pine Bluff, Ark.

Electrical Supply Jobbers' Association. Annual meeting, Homestead Hotel, Hot Springs, Va., May 21-22-23. Secretary, Franklin Overbagh, 411 South Clinton street, Chicago.

Electrical Contractors' Association of Georgia. Annual meeting, Tybee Island, Ga., June, 1918. Secretary, Dan Carey, 614 Chamber of Commerce building, Atlanta, Ga.

American Society of Mechanical Engineers. Spring meeting, Worcester, Mass., June 4-7. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

National Electric Light Association. Annual convention, Hotel Traymore, Atlantic City, N. J., June 13 and 14. Secretary, T. C. Martin, 33 West 39th street, New York City.

Texas State Association of Electrical Contractors. Annual meeting, Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Southeastern Section, National Electric Light Association. Annual meeting, Atlanta, Ga., June 19-20, 1918. Secretary-Treasurer, T. W. Peters, Columbus, Ga.

American Institute of Chemical Engineers. Summer meeting, Berlin, N. H., June 19-22. Headquarters, Mt. Madison House, Gorham, N. H. Secretary, John C. Olsen, Brooklyn, N. Y.

United States Independent Telephone Association. Annual convention, Hotel La Salle, Chicago, Ill., June 25-28. Secretary, W. S. Vivian, 19 South La Salle street, Chicago, Ill.

American Institute of Electrical Engineers. Annual convention, Atlantic City, N. J., June 26-28. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 10-12. Secretary, D. L. Gaskill, Greenville, Ohio.

National Association of Electrical Contractors and Dealers. Annual convention, Cleveland, Ohio, July 17-20. Secretary, Harry C. Brown, 101 West 40th street, New York City.

Northwest Electric Light and Power Association; affiliated with N. E. L. A. Annual meeting, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

International Association Municipal Electricians. Annual convention, Atlanta, Ga., September 24-27. Secretary, Clarence R. George, Houston, Tex.

AURORA, ILL.—Employes of the Aurora, Elgin & Chicago Railroad Company subscribed over $50,000 for Third Liberty Loan bonds. They also voted to purchase about $1,000 or bonds with funds in the treasury of their organization, all interest from which is to be expended for worthy war causes, such as the Y. M. C. A., Red Cross and the Knights of Columbus.

CAIRO, ILL.—Upon orders received from Director-General McAdoo the great bridge of the Illinois Central Railroad Company across the Ohio River at this point has been lighted with electricity.

DIXON, ILL.—The proposed rates for increases proposed by the Sterling, Dixon & Eastern Railway Company has been suspended by the Illinois Public Utilities Commission.

DIXON, ILL.—The Illinois Public Utilities Commission has suspended until September 28 the proposed increase in rates for electric current. This is an important ruling as 50 towns and cities are affected by the order.

EAST ST. LOUIS, ILL.—It has been determined that East St. Louis can not furnish power for the proposed new nitrate plant which the United States Government proposes to erect. The 35,000 kilowatts demanded will tax the supply of the Keokuk hydroelectric plant, unless other consumers are reduced or omitted. Congressman Rodenberg believe that otherwise East St. Louis would have a fair chance to secure the nitrate plant.

EAST ST. LOUIS, ILL.—The Illinois Public Utilities Commission has suspended until September 17 the proposed increase for power service filed by the East St. Louis Light & Power Company and the proposed increase in electric rates filed by the Alton Gas & Electric Company.

PECATONIA, ILL.—The installation of an electrically-operated pump at the pumping station is under advisement of the council.

QUINCY, ILL.—Buerkin & Kaemper have secured a contract for the erection of a new city pump house to cost $2,241. Menke Stone & Lime Company will lay the foundation.

RED OAK, IOWA.—Red Oak Electric Company has applied to the board of county supervisors for a franchise for electric transmission lines on certain roads in Pleasant township.

LIBERTY, MO.—Liberty Electric Light Company has asked the Public Utilities Commission for permission to increase its rates. Trenton, Mo., to which it furnished current, will fight any such increase.

GUEDYDAN, LA.—Citizens have voted $15,000 bonds for an electric light system.

CONCORDIA, KANS.—$10,000 damage was done recently to the United Telephone Company's lines here by a snowstorm which broke poles and wires over the territory.

LEAVENWORTH, KANS.—For several weeks experts at Fort Leavenworth have been taking an inventory of the telephone lines operated by the Leavenworth People's Telephone Company and the Leavenworth Light, Heat & Power Company's power and light lines with the view of the government taking over the telephone and electric equipment and operating it as a separate community.

PLAINVILLE, KANS.—J. H. Lee secured the contract for putting in the new transmission line from Plainville to Palco and also wiring for distribution system. The Mill Company, which is to supply the electricity for lighting poles reserves the right to use the line and may put in electricity at Zurich.

QUINTER, KANS.—An election which was held recently voted $5,000 for improvements to the electric light plant. H. U. Porter, city clerk.

WILSON, KANS.—The city is furnishing current to the town of Weber, Kans., which in turn is selling it to Dorrance, Kans. This arrangement is temporary until Dorrance can vote bonds to purchase the Weber transmission lines.

SCHUYLER, NEB.—Bond issue was defeated to vote bonds in sum of $40,000 for electrical improvements.

SOUTH CENTRAL STATES.

LYLES, TENN.—In connection with the proposed construction of a large new plant for the manufacture of wood chemicals by the Bon Air Coal & Iron Corporation, of Nashville, plans are now under consideration for the erection of a large power house for works operation.

RUTHERFORD, TENN.—Bonds to the amount of $10,000 have been voted for establishing municipal lighting. Address mayor.

ENSLEY, ALA.—Southern Bell Telephone & Telegraph Company will expend $17,000 in enlarging its plant. Address chief engineer at Atlanta, Ga.

DANVILLE, ARK.—The sum of $2,000 was recently subscribed by citizens to start operation of the electric light plant.

PRAGUE, OKLA.—Election to vote $30,000 bonds for electrical improvements and $15,000 for water works improvements recently carried.

SHATTUCK, OKLA.—Bonds to the amount of $75,000 have been voted for electrical improvements. Burns & MacDonald, engineers, Kansas City.

AUSTIN, TEX.—Dallas Light & Power Company, of Dallas, filed an amendment to its charter April 29, decreasing its capital stock from $1,400,000 to $20,000. This company was recently absorbed by the Texas Power & Light Company of Dallas.

BRACKETTVILLE, TEX.—Extensive improvements are to be made here to the electric light plant.

DEL RIO, TEX.—The city council of Del Rio has taken steps to construct a municipal electric light and power and water works plant. Bonds will be issued for the purpose.

MERCEDES, TEX.—Mercedes Water, Light & Power Company will install a new engine of 100 horsepower capacity and a generator. When the new equipment is in operation an all day electric power and light service will be given at Mercedes.

WESTERN STATES.

BUTTE, MONT.—About $70,000 will be expended by the Butte Electric Railway Company within the next few weeks on track and street improvements, including double tracks, new switches, etc.

CHEHALIS, WASH.—Question of granting a franchise to C. E. Anderson and others of Portland for a light and power system here was decided in the negative.

EVERETT, WASH.—An investigation will be started at once by Engineer Burns of Burns & McDonnell, Kansas City, of the proposed power project for Everett to determine its capabilities in commercial force and for determining the cost of a unit on the Upper Sultan river.

HANFORD, WASH.—Blackrock Power & Irrigation Company has petitioned for authority to construct a transmission line about 35 miles long.

NEWPORT, WASH.—Calispell Valley Lighting & Power Company has been organized with a capital of $10,000 by Dr. J. L. Rogers and others.

SEATTLE, WASH.—Contract has been awarded for labor and materials for the proposed elevated municipal line to G. Geske & Company Pacific building at $16,186.50.

SEATTLE, WASH.—The board of public works has closed a contract for 514 tons of 60 pound rails for the municipal elevated railway, with the Industrial Machinery Company, Smith building, at $68 a ton, including angle bars.

SPOKANE, WASH.—According to the testimony of D. L. Huntington, president of the Washington Water Power Company, construction of its proposed Niagara system power plant here with a capacity of 40,000 horsepower will be necessary in two years if the business of the company continues to grow as it has during the past year. The testimony was given before the joint public service commissions of Washington and Idaho, held at Spokane recently for the purpose of establishing a basis for revaluation of the property of the company.

REVELSTOKE, B. C.—Lanark Mines Company plans the early expenditure of between $25,000 and $30,000 in erecting a power plant and installing equipment. W. B. Dornberg of Spokane is manager of the concern.

SOO, ONT.—Fire recently destroyed a large portion of the power plant of the Great Lakes Power Company with an estimated loss of $150,000.

ASTORIA, ORE.—Contract has been awarded to the Ewart Electric Company for installation of electric wiring and material for the bulk grain storage bins and workhouse of the port of Astoria at $9,588.

MARSHFIELD, ORE.—Umpqua Light & Power Company is having preliminary plans prepared for the construction of a new power line across the Umpqua river at Reedsport. This company recently took over the Gardinery Light & Power Company.

PORTLAND, ORE.—Pacific Power & Light Company is planning for the immediate construction of 6,600-volt, three-phase lines for supplying service to two beet sugar factories of the Utah-Idaho Sugar Company. It is planned to commence work at an early date on the construction of a new outdoor substation near Kahlotus for the purpose of furnishing service to this city.

SEATTLE, WASH.—The local office of the Stone & Webster Company, 120 Broadway, New York, has been awarded the contract for the construction of a new coal conveyor, concrete tunnels and hopper adjacent to the power house of the Puget Sound Traction, Light & Power Company at 6600 Fourteenth avenue, S.

SALEM, ORE.—The Crown Willamette Paper Company has the approval of the state engineer to appropriate 200 second feet of water from the Youngs River near here for development of 2273 horsepower. It is estimated that the cost will be $150,000 and involves the construction of an 80 foot dam, pipe line and power house.

BISHOP, CAL.—Nevada-California Power Company is considering plans for the construction of a high tension transmission line to Ely, Nev., to cost about $300,000.

BOLINAS, CAL.—Chetco Mining Company is planning for the immediate installation of new electric pumping equipment at its local properties.

FRESNO, CAL.—The city is having plans prepared for the installation of an electrolier system on South Van Ness avenue extending to California street. Clarence Murray is city engineer.

FRESNO, CAL.—San Joaquin Light & Power Company has recently commenced the construction of a large substation near the Standard reservoir farm. This station will step down the current transmitted at 60,000 volts from the Crane Valley power house district, to the lower voltage required in this section. Four 1,000 kilovolt-ampere transformers with auxiliary equipment will be installed.

PROPOSALS

ELECTRIC LIGHT PLANT.—Bids will be received until 2 p. m., May 20, by the Commissioner of Indian Affairs, Department of Interior, Washington, D. C., for the installation of an electric light plant at Southern Ute School, Colo.

ELECTRIC PUMP.—Bids will soon be received for the construction of a water works system, which will involve an electric pump, 1¾ miles of 6-inch cast iron as well as other material. The estimated cost of the system is $36,000. Address J. H. Kolzow, city clerk.

ELECTRIC LIGHT SYSTEM.—Bids will be received on May 25 by the county commissioners for installing an electric light system for bridge and viaduct over the Miami river between Middletown and West Middletown, including the furnishing and placing of conduits, metal globe holders, etc. Address W. W. Crawford, county clerk, Hamilton, Ohio.

CONDUIT.—Bids will be received May 21 by the commissioner of gas and electricity, Room 614 City Hall, Chicago, for the following material: 1,000 feet 3-inch conduit, 700 feet 2½-inch conduit, 1,000 feet 2-inch conduit, 500 feet 1½-inch conduit, 3,000 feet 1-inch conduit, 2,000 feet ¾-inch conduit and 10,000 feet ½-inch conduit. Address William G. Keith, commissioner of gas and electricity.

MATERIAL FOR TRANSMISSION LINE CONSTRUCTION.—Bids will be received on May 25 for labor and material for the construction of a transmission line and transformer station for Caledonia, Ohio. The specifications include pole line complete with poles, pins, insulators, guy wire, copper line wire, lighting arrester, ground plates, ground wires. Bid is to cover 25 kilovolt-ampere transformers, two 10-kilovolt-ampere, 6.6 ampere constant current transformers, fused switches and all labor and material. G. W. Hurles, clerk.

AIR COMPRESSOR.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for a motor-driven air compressor for the navy yard at Philadelphia. Address C. W. Parks, chief of the bureau.

Trade Activities

D. C. and Wm. B. Jackson Suspend Business—Sundh Electric Moves Main Offices from New York—Catalogs

Sundh Electric Company announces the removal of its main offices and factory from New York City to Newark, N. J. The New York office formerly maintained at 548 West Twenty-third street will be located at 51 East Forty-second street.

Harvey Hubbell, Inc., Bridgeport, Conn., in the spring number of **The Hubbellite,** illustrates in striking style many of the Hubbell electric specialties—receptacles, sockets, holders, reflectors, plugs for electric fans, and Hubbell double-current tap for operating two appliances at the same time. All these specialties are well described.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has recently issued a small two-color envelope folder, publication No. 242, illustrating and describing both single and two-circuit brass shell and all porcelain pendant switches. The approved C-H high capacity quick break mechanism is used in this line, the operating push buttons of which are a part of the mechanism and do not loosen up, twist or become lost. This folder is issued for general distribution and for jobbers' use, when imprinted with the jobber's name.

Moran & Hastings Manufacturing Company, Chicago, has issued edition No. 36 of its lighting fixture catalog. This, as usual, is gotten up in very handsome style and includes hundreds of designs of the latest types of ceiling and wall fixtures. Among the numerous designs are many very attractive ones and including not only standard artistic patterns but many unique creations. The designs are so varied as to suit the requirements of various tastes. The catalog also includes entrance lanterns, pedestal lamps, floor lamps, piano, desk and table lamps, etc. Fixture parts are also included.

Central Electric Company, Chicago, has issued new catalog No. 41, of over 300 pages, skillfully laid out, neatly printed and elaborately illustrated. The work covers the field of automobile supplies, setting forth a most extensive and serviceable line. Supplies and appliances of a similar class are conveniently grouped under separate headings, and in the back part of the book is a complete index to all classified supplies and parts. It will especially appeal to automobile users, dealers, repair and garage men. Such utilities as headlights, tail-lamps, searchlights, spotlights, battery-charging outfits, tire pumps, vulcanizers, electric cable and dry batteries, and hundreds of kindred accessories, with necessary data and prices, serve to indicate the scope covered. The company's publicity department showed high efficiency in the execution of this work.

Great Lakes Electric Manufacturing Company, manufacturer of motors and generators, Chicago, announces its removal from 700 West Twenty-second street to 200 North Jefferson street.

Okey Manufacturing Company, manufacturer of electric light plants at Columbus, Ohio, is erecting a new machine plant at Naghton and Water streets, which will soon be ready for occupancy. The new plant is brick and mill construction, with splendid lighting facilities, and will enable the company to handle its rapidly increasing business more advantageously.

D. C. & William B. Jackson, consulting engineers, Chicago, have closed both their Boston and Chicago offices, and will suspend business for the duration of the war. As previously stated in the ELECTRICAL REVIEW, both of these gentlemen have been commissioned majors and have received orders to report for immediate service. D. C. Jackson has been detailed for service in France and William B. Jackson will presumably remain in this country. Edward L. Moreland, a third member of the firm, is closing up the affairs of the company, and is also desirous of getting into government service in some capacity as soon as he can complete the work now in hand.

Burke Electric Company, Erie, Pa., in a recent announcement states that as soon as the housing project shaped itself sufficiently to warrant it, an addition to its plant just east of its main works will be erected. The company has leased for a period of ten years four acres of land in a tract adjoining its present plant on which temporary buildings will be erected. Seventy-five per cent of the operations of this addition will be by girls, because of the fact that with so many men in government service, additional male labor is practically impossible to obtain. It has also been stated that the company plans in the near future to open a branch in Conneautville for a new line of electrical equipment.

Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing circular No. 501, entitled "Universal Battery Charging Rheostats for Garage Duty," and briefly summarizes the garage problem of charging batteries. The rheostats described in this leaflet can be used to charge any number of cells. Type "U R" is designed to control the charge of any number of calls from 1 to 44 lead cells or 1 to 60 Edison cells in series on a 100 to 125-volt supply circuit. Another type shown is "URK," which is the Universal rheostat with an interlocking overload and underload release circuit breaker as a part of it. Tables, showing the charging rates together with other information in regard to this line of rheostats, are contained in the leaflet.

Woodrow Manufacturing Company, Newton, Iowa, has issued a number of folders on the new washing machine, which has been cleverly called the Woodrow "Tilting-Twin" washer. The distinctive feature of this machine is that it has two independent tubs, which can be easily tilted for quick draining. The folders describe the construction and unique features of the machine and show its numerous advantages.

Electric Storage Battery Company, with general offices and works at Philadelphia, Pa., and branch offices in the principal cities of the country, recently issued a bulletin describing and illustrating the "Exide" battery for portable signal services. The design of these batteries throughout is such as to eliminate internal losses, and thus render practically the entire capacity of the plates available for the demands of the external circuit. Each part of the battery is well illustrated and described. Portable batteries of Types KXS and KXCS have been specially designed and developed by the Electric Storage Battery company to meet the requirements of railway signal service.

The Electric Controller & Manufacturing Company, Cleveland, Ohio, desires to correct a misunderstanding that may have resulted because of a typographical error in its advertisement appearing on the front cover of the ELECTRICAL REVIEW for May 4. The advertisement related to the company's automatic compensator for induction motors and referred to the ease of operation with this equipment. By pushing the starting button the motor is thrown into the starting connection. After it has reached a safe speed it is automatically thrown into the running connection. The word "running" in the advertisement was given as "reversing," thus creating an erroneous impression as the outfit is not a reversing one.

Link-Belt Company's illustrated book No. 312 deals specially with the Link-Belt silent-chain transmission as applied to the machine tool industry. In these days when every effort toward increasing production is being made, the Link-Belt silent chain drive stands out as one of the most efficient mediums for the transmission of power, and has received the hearty endorsement of progressive and experienced machine tool builders. Among the claims set forth favorable to this product of the Link-Belt Company are its flexibility, positiveness and durabilty, and the value of these points when applied to the machine tool industry are clearly set forth. Attention is directed to the adaptabilty of the Link-Belt silent-chain transmission in cement plants, paper mills, grain elevators and textile mills. The book contains much helpful information and numerous illustrations, showing typical installations of the Link-Belt silent-drive in representative machine tool plants.

Recent Patents

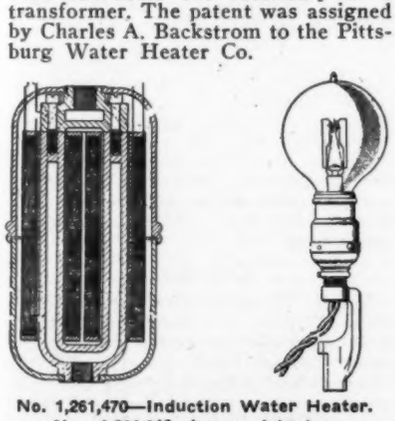
Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Pendent Switch (1,261,456).—This patent to Clarence C. Stirling, of Hartford, Conn., is one of a recently issued series of patents assigned to the Hart & Hegeman Mfg. Co. and relating to pendent switches operated by a transverse bar which projects at both ends from the casing of the switch. In this case, the bar carries a wedge which raises a roller and passes under this roller when the bar is slid in either direction. The roller itself forms the movable contact of the switch and is floatingly mounted on a coiled spring which forms a flexible axis for it.

Electrode for Use in Welding (1,261,395).—In using a metal rod as an electrode in welding, the dropping of the molten metal from the rod momentarily interrupts the arc and interferes more or less with the welding operation. To avoid this, Malcolm W. Irvine, of Glasgow, Scotland, uses an iron rod wrapped with asbestos paper or pulp saturated with a mixture of an oxide of iron, sodium carbonate and sodium silicate. The heat of the arc reduces the oxide of iron to a metallic condition, thus forming a conducting ring of metal around the crater of the arc, which maintains the continuity of the arc even though the iron core of the electrode is detached in drops. It is claimed that this permits of more speedy welding and that the yellow tint imparted to the arc reduces the danger of injuring the eyes.

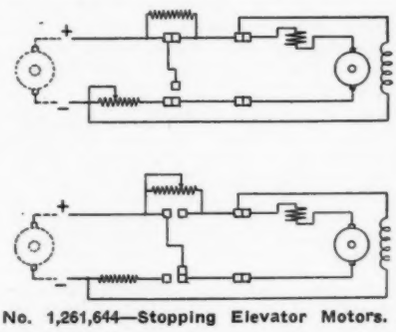
Induction Water Heater (1,261,470).—The water flows through a U-shaped iron tube, both shanks of which are surrounded by windings and thus constitute the secondary of a transformer. The patent was assigned by Charles A. Backstrom to the Pittsburg Water Heater Co.



No. 1,261,470—Induction Water Heater.
No. 1,261,613—Lamp Adapter.

Arc-Lamp Attachment (1,261,613).—To expedite the substitution of a tungsten lamp for an arc lamp within a reflector, James R. Pratt, of Denison, Texas, mounts an incandescent lamp socket on a bracket adapted to be gripped in the carbon holder of the arm lamp.

Stopping Electric Motors (1,261,644).—In electric elevator practice it has been customary to provide an extra field winding on the motor, so as to increase the field strength when slowing down and stopping the motor. As a substitute for this extra winding, Walter C. Strang, of Yonkers, N. Y., increases the field strength of the motor by applying to the regular field winding a potential in excess of the main line potential while the motor is rotating and the main line circuit to the motor armature is broken. The patent was assigned to the Otis Elevator Co., of New York City, and our illustrations show the connections during the starting and the stopping of the motor.



No. 1,261,644—Stopping Elevator Motors.

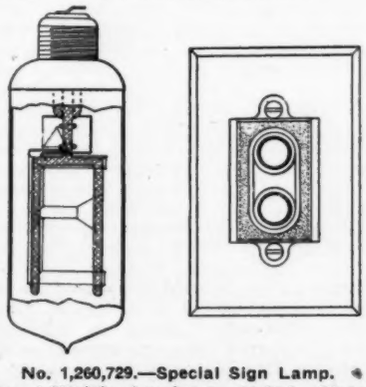
Temperature Regulating Means (1,261,086).—The now widely known electrical method of measuring the flow of gas through large pipes depends on the fact that a heated body within the pipe will be cooled more or less rapidly according to the rate at which the gas is flowing. However, the accuracy of this method is affected by variations in the specific heat of the gas due to variations in temperature. To overcome this, John C. Wilson and Horace N. Packard, of Milwaukee, modify the temperature of the gas by means which are controlled by a resistance so constructed as to vary in value in the same characteristic manner as the specific heat of the gas. The patent stands assigned to the Cutler-Hammer Mfg. Co.

Circuit-Interrupter (1,261,677).—Under this title, Winfield A. Atwood, of Schenectady, N. Y., has patented an operating arrangement for use with a group of independent circuit-breakers. The operating mechanism automatically returns the tripping means from the tripping position to a non-tripping position, and the actuating means are held there until the last circuit-breaker is closed. The patent was assigned to the General Electric Company.

Rotor for Squirrel-Cage Motors (1,261,673).—Where solid steel rotors are used on single-phase turbo-alternators, it is difficult to find a suitable location for the short-circuited squirrel-cage winding used in addition to the regular field winding of the rotor. To overcome this difficulty, E. F. W. Alexanderson, of Schenectady, N. Y. (in this patent assigned to the General Electric Co.), places the squirrel-cage bars in slots much wider than the slots provided for the field coils, and directly over the wedges which hold the field coil windings in place.

Electric Heater (1,260,564).—For a simple water heater, Carl E. Magnusson and Leslie F. Curtis, both of Seattle, Wash., construct a tubular transformer in which the inner or secondary winding consists of a sheath of nonmagnetic metal closely fitting a hollow core through which the water can flow.

Sign Lamp (1,260,729).—Where each lamp is to have a luminous portion shaped to form a letter, Johann E. C. Struve, of Hamburg, Germany, strings the metal filament so that part of it is in the letter-forming section of the bulb, while another part is concealed by a dulled bulb section.



No. 1,260,729.—Special Sign Lamp.
No. 1,257,473.—Luminous Switch Plate.

Luminous Switch (1,257,473).—To enable a push-button switch to be located in the dark, Maxwell C. Frank, of Piedmont, Cal., cuts out the part of the face plate of the switch surrounding the buttons, thus making a frame. In this frame he mounts a sheet of luminescent glass-covered material.

Men in Service

William B. Jackson Appointed Major in Engineering Service—United Gas & Electric Engineering Well Represented

MAJOR JOHN COFFEE HAYS, officer in charge of utilities at Camp Lewis, Wash., was recently appointed construction quartermaster, succeeding Lieut. Col. James Como, who has been both camp and construction quartermaster.

MAURICE DOMANGE, for many years sales manager of the Western Electric Company at Paris, and who, since the beginning of the war, has been at Verdun, first as a lieutenant and later as a captain of the French Artillery, has been made a Chevalier of the Legion of Honor.

WILLIAM A. FIELD, who for the past year has been general manager of the United Alloy Steel Corporation, one of the largest manufacturers of electric steel and special alloy steels, has resigned to accept a position with the Emergency Fleet Corporation, United States Shipping Board.

RAY D. FLAVIN, until recently assistant advertising manager of ELECTRICAL REVIEW, has enlisted in the navy and is in training at Camp Logan, Illinois. Mr. Flavin is a close student of advertising and, although he is still a very young man, his knowledge and understanding of advertising covers the subject in all its branches. He is a graduate of St. Ignatius College, Chicago, and prior to his connection with the ELECTRICAL REVIEW was associated with the George Batten Company.

WILLIAM B. JACKSON, well known as a consulting engineer, has been commissioned a major in special engineering service of the Army. Major Jackson has had an interesting career. In 1890 he was graduated in mechanical engineering from Pennsylvania State College, then spent several years in Colorado and in 1893 took charge of the Pennsylvania mining exhibit at the Chicago World's Fair. A year with the United Electric Light & Power Company, of New York City, as inspector, was followed by five years' service with the old Stanley Electric Manufacturing Company. In 1899 Major Jackson became general superintendent and chief engineer of the Colorado Power Company, and two years later he again joined the Stanley company as traveling engineer. In 1902 he entered the consulting engineering business with his brother, Prof. Dugald C. Jackson, under the firm name of D. C. & Wm. B. Jackson. Originally located in Madison, Wis., the firm's office was moved to Chicago in 1907 and shortly afterward a Boston office was also established. Both offices have just been closed because all members of the firm are now in government service. Major W. B. Jackson was president of the Western Society of Engineers in 1915 and has just been elected one of the vice-presidents of the American Institute of Electrical Engineers.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.

J. F. MULLER, JR., of the Birmingham office of the United Gas & Electric Engineering Company has resigned to join the Aviation Corps and is now located at Austin, Texas.

E. A. ABBOTT, formerly a lamp specialist at the Dallas branch of the Western Electric Company, is now studying for a commission in the aviation section of the United States Army and is at present stationed at the Agricultural and Mechanical College, College Station, Texas.

SOUTHWESTERN BELL TELEPHONE COMPANY displays a service flag in front of its St. Louis building, which shows the figures 565, representing that number of its employees now in military service. During the month of April, 28 Bell employees left the service of the company to join the colors.

CHARLES E. MONK, formerly a member of the sales department of the Cincinnati branch of the Western Electric Company, was recently promoted from the rank of first lieutenant to captain. He is commander of a company in the 105th Field Signal Battalion and is now stationed at Camp Sevier, S. C.

UNITED GAS & ELECTRIC ENGINEERING CORPORATION, 61 Broadway, New York City, has issued as a supplement to the May issue of the Bulletin, an artistically gotten up roll of honor, carrying the names of 524 employes of the parent company and its subsidiaries who are now in the service of their country. The enlistments from the various districts of the company are as follows: Birmingham, 121; Bloomington, 2; Buffalo, 117; Colorado Springs, 5; Elmira, 14; Harrisburg, 17; Houston, 42; Knoxville, 9; Lancaster, 35; Leavenworth, 1; Little Rock, 23; Lockport, 5; Memphis, 52; New Orleans, 57; New York, 5; Richmond, 1; Terre Haute, 2; Wilkes-Barre, 15.

CAPTAIN GORDON H. MCCOY, formerly of the sales department of the Utah Power & Light Company, Salt Lake City, Utah, is now connected with the Field Artillery, School of Fire, at Fort Sill, Okla.

W. S. VIVIAN, secretary of the United States Independent Telephone Association, is with the Signal Corps "somewhere in France." He was given a three years' leave of absence by the board of directors of the association.

FRANK F. HOWE, an old and well known electrical man of Milwaukee, can take just pride in being at the head of a family which is engaged heart and soul in the service of its country. Mr. Howe's three sons enlisted in the army, and two of them, Nathan C. and Frank F., Jr., have for some time been "somewhere in France," the former with the artillery and the latter in ambulance service. The third son, Joseph C., has qualified and awaits call with the special searchlight division (56th U. S. Engineers). Mrs. Howe and her three daughters have been very strenuously engaged in Red Cross, Liberty Bond, Thrift Stamp and other activities open to women. Mr. Howe himself tried to enlist in the searchlight division, but on account of his age could not be accepted. He has been in the electrical business over 30 years, having served his apprenticeship days with the old Edison and Westinghouse companies. In 1889 he organized the Orr & Howe Electric Company, which engaged in contracting work in Pittsburgh. On the retirement of his partner during the following year he became sole proprietor and manager of the company, which continued in business some 20 years. In 1909 he accepted the position of chief electrician in charge of the electrical equipment of all of the rivercraft of the Pittsburgh Coal Company. In 1912 he joined the sales forces of the Westinghouse Electric & Manufacturing Company in the Pittsburgh district. Since he came to Milwaukee he has represented the George F. Rohn Company and later the Burdick Electric Company. During the last two years, as the result of an accident, he has been unable to engage in active work.

Obituary.

MAJOR CHARLES G. BAIRD, Signal Corps, U. S. A., is reported among those dead from disease in the casualty list from General Pershing. He was the chief of the entire telephone and telephonic service of the American Expeditionary Force in France. Major Baird entered the army immediately after the declaration of war and organized the 413th Telegraph Battalion, which was one of the first of the Signal Corps units ordered overseas. He has been recognized as one of the leading experts of the country on railroad signal equipment.

Personal

A. W. Leonard to Direct State Training Camp Activities—W. A. Durgin Promoted—Frank E. Getts Dies Suddenly

IVY CARR has been appointed manager of the Crawfordsville Electric Light & Power, Crawfordsville, Ind., to succeed F. H. Miller.

D. C. GOULD, who has for a number of years been assistant district manager in Chicago territory of the Willard Storage Battery Company, has been transferred to Indianapolis, Ind., where he will act as manager of that branch.

T. D. RAUCH has been placed in charge of the new complaint department which has been instituted recently by the Little Rock Railway & Electric Company, Little Rock, Ark., for the purpose of centralizing the settling of complaints.

GEORGE P. SMITH, formerly assistant manager of the Western Union Telegraph Company at Newark, N. J., has been appointed manager for the Easton (Pa.) office of the company, succeeding S. H. Flynn, who has been transferred to Poughkeepsie, N. Y.

P. F. MAGEE, formerly district representative for the Willard Storage Battery Company, Seattle, Wash., in the San Joaquin Valley, California, has been transferred to Seattle and will handle the state of Washington for the Willard company.

G. W. OLIVER recently joined the staff of the United Gas & Electric Engineering Corporation's statistical department in the New York office. Mr. Oliver was formerly cost accountant with the Brooklyn Union Gas Company and later a statistician for one of the large chain store systems.

F. T. MORRISSEY has resigned his position as manager of the Eldorado Illinois group of properties of the Southern Illinois Utility Company to become electrical engineer for the Indiana Railways & Light Company, Kokomo, Ind., filling the place made vacant by the resignation of George H. Losey.

A. W. LEONARD, president of the Puget Sound Traction, Light & Power Company, Seattle, Wash., and who is prominently identified with the Soldiers' and Sailors' Club, has been placed in charge of training camp activities for the state of Washington. This appointment came through the recommendation of the State Council of Defense and is another instance where utility men are playing such an important part in the execution of the war.

O. W. JONES, commercial manager of the Texas Power & Light Company, Waco, Tex., has been appointed manager of the Cleburne district of the company with headquarters at Cleburne. Mr. Jones joined the company during the latter part of 1916, having in subsequent years been engineer of distribution of the Columbus Railway, Light & Power Company, Columbus, Ohio, and superintendent of the meter and distribution department.

GEORGE D. POWELL, formerly a draftsman in the maintenance of way department of the Union Traction Company of Indiana, Indianapolis, Ind., has been promoted to the position of office engineer of that department.

G. V. P. LANSING, 508 West One Hundred and Twelfth street, New York City, has been appointed New York representative for the F. S. Payne Company, Cambridge, Mass., manufacturer of electric elevators.

FAY GRIFFITH, who has been superintendent of the lighting department of the Little Rock Railway & Electric Company, Little Rock, Ark., has been promoted to the position of superintendent of light and power and has taken over both the meter and line departments of the company.

DONALD L. DWYER, formerly assistant chief accountant of the State Public Utilities Commission of Illinois, has severed his connection with the public utilities department of Baker, Vawter & Wolf and has opened an independent public accountant office, with headquarters in the DeWitt Smith building, Springfield, Ill.

DR. A. E. KENNELLY, acting head of the electrical engineering department of the Massachusetts Institute of Technology, has been awarded the Howard N. Potts gold medal by the Franklin Institute, for his invention of the hot-wire anemometer and his application of this device to the measurement of convection from small heated wires.

FRED W. GODFREY has severed his connection with the Republic Electric Company to become associated with the American Carbon & Battery Works of the National Carbon Company, East St. Louis, Ill. Mr. Godfrey's territory will comprise the states of Minnesota, the Dakotas, Nebraska, Colorado, Montana, Wyoming, Utah, Idaho and New Mexico.

J. H. SROUFE, of the Jagger-Sroufe Company, Portland, Oregon, was elected president of the Portland Association of Electrical Contractors and Dealers at a recent meeting. Mr. Sroufe formerly was with the NePage-McKenny Company, for several years having had charge of its Portland office. He has been very active in the affairs of the Portland and Oregon association work.

WILLIAM A. DURGIN, for some time assistant testing engineer of the Commonwealth Edison Company, has been assigned to the office of Louis A. Ferguson, vice-president of the company, as lighting assistant to the vice-president. In his new position, Mr. Durgin will follow the technical development of lamps and lighting, work in which he has been engaged for some time and developed a high degree of importance within the company, and other special problems to which he may be assigned from time to time by Mr. Ferguson.

NORMAN B. HICKOX has been appointed advertising manager of the National X-Ray Reflector Company, Chicago, succeeding Charles E. Wittmack, who recently resigned to take up other duties. In addition to having charge of the publicity department, Mr. Hickox will continue to act as the special personal representative of Augustus D. Curtis, president of the company, in sales promotion work throughout the West. Mr. Hickox is a Jovian and is well known in electrical circles. He is a member of the Chicago Electric Club-Jovian League, National Electric Light Association and the Illuminating Engineering Society.

W. S. RUGG has resigned his position as district manager of the New York sales office of the Westinghouse Electric & Manufacturing Company to become manager of the railway department of the company with headquarters at Pittsburgh. Mr. Rugg will succeed C. S. Cook, who recently resigned to become general manager of the Duquesne Light Company, Pittsburgh, Pa.

GEORGE C. KNOTT, formerly sales and advertising manager of the Wirt Company, Germantown, Pa., has formed a partnership with George L. Hatheway of New York City. The new firm will be known as Hatheway & Knott, and will engage in the distribution of products of various electrical manufacturers. Mr. Knott was for many years associated with the Benjamin Electric Manufacturing Company, Chicago.

Obituary.

FRANK E. GETTS, general manager of the Electrical Engineers' Equipment Company, Chicago, died suddenly at Los Angeles, Cal., on May 7. He was on a combined business and pleasure trip in the West accompanied by Mrs. Getts. Apparently in perfect health, his sudden death came as a great shock to his many friends. Mr. Getts was born in Indiana, near Fort Wayne, in 1874; he learned the machinist's trade in the Wabash railroad shops, and worked for some years in the old Fort Wayne Electric Works. He later became connected with the Siemens-Halske Company of America and when this was taken over by the General Electric Company, he joined the construction department of the latter. For some 15 years he was engaged in electrical and later in turbine construction in various portions of the country. In 1903 he came to Chicago to take charge of the erection of the historic steam turbines at the Fisk Street station of the Commonwealth Edison Company, which occupied his attention for a number of years. In 1912 he became Chicago representative of the Alberger Pump & Condenser Company. In 1914 he accepted the position of general manager of the Electrical Engineers' Equipment Company, which he held at the time of his death. Mr. Getts was buried at Lafayette, Ind., on May 14. Many of his friends attended the funeral services.

Financial News

Northern Ontario Light Earnings Show Increase.

Earnings of Northern Ontario Light & Power Company for the quarter ending March 31, 1918, show an increase over the corresponding period of last year both as to gross and net, despite the large increase in operating costs.

	1918.	1917.
March gross	$ 76,688	$ 73,329
Net earnings	56,559	56,293
Surplus after charges	33,529	33,513
Three months' gross	230,212	219,840
Net earnings	171,458	169,444
Surplus after charges	102,868	101,104

In its annual statement for the year ending December 31, 1917, there was charged off for depreciation $180,000 and not $50,000 as previously stated. These reserves were credited as follows:

For depreciation, $100,000.
For depreciation of investments, $20,000.
For general purposes, $60,000.

After these deductions from the net earnings, with an additional item of $20,000 for war taxes, there remained a surplus of $37,000 compared with $44,980 in 1916. Total amount charged off for depreciation in 1917 was $50,000 in excess of that charged the previous year.

Buffalo General Electric Seeks Authority to Reimburse Treasury.

The Buffalo General Electric Company has filed with the Public Service Commission, a supplemental application asking permission to use $2,605,371, proceeds of debentures, authorized under a commission's order August 8, 1917, for the purpose of reimbursing the company's treasury for expenditure for acquisition of property, construction, completion, extension and improvement of its plant and distribution system since December 31, 1913, and $1,062,629 to apply toward the payment of the expense of construction of new improvements of plant and distributing system. The commission will take immediate action upon the petition.

Light Companies to Merge.

The Public Service Commission has authorized the Norwich Gas & Electric Company, the Oneonta Light & Power Company and the Homer & Cortland Gas Light companies to merge with the Ithaca Gas & Electric Corporation, the latter having acquired the entire issued and outstanding capital stock of the three companies. The commission also has approved the acquisition by the Associated Gas & Electric Company of $168,300 capital stock of the Ithaca Gas & Electric Corporation as of October 21, 1916, and $576,200 as of December 29, 1916.

Childers Electrical Company Increases Capital Stock.

The Childers Electric Company, anticipating the heavy demand for motors and electrical apparatus which would follow the entry of this country into war, has added very materially to its stock and now has, it claims, the most complete line in the South. Due to this large stock its business has increased in volume it has been found necessary to increase the capital stock of the company from $4,000 to $20,000. The incorporators of the company are C. C. Childers, William Ziegler and A. G. Renan, Jr.

Portland Company Decreases Stock.

At the annual meeting of the stockholders of Portland Railway, Light & Power Company held recently, it was decided that the capital stock of the company be decreased. The amendment to the articles of incorporation authorized a decrease of $5,000,000 placing the present capitalization of the company at $35,000,000.

Gains Made by Power Company.

The revenues of the Coast Power Company of Tillamook, Ore., amounted to $31,304.86, during 1917, a gain of $8,099 over the previous year. Operating expenses for the year amounted to $19,487.18.

Dividends.

The board of directors of the Kings County Electric Light & Power Company has declared a regular quarterly dividend of $2.00 per share on the amount of the capital stock outstanding, payable on June 1 to stockholders of record May 21.

Pensacola Electric Company has declared a regularly semi-annual dividend of $3 per share on preferred stock, payable June 1 to stock of record May 15.

Central Arkansas Railway & Light Company has declared a quarterly dividend of 1¾ per cent on preferred stock, payable June 1 to stock of record May 15.

Page Steel & Wire Company has declared a dividend of 3 per cent on the first preferred stock and 3½ per cent on the second preferred, both payable May 31 to stock of record May 20.

Cerro de Pasco Copper Corporation has declared a quarterly dividend of $1 a share, and an extra dividend of 25 cents a share, payable June 1 to stock of record May 20.

Niagara Falls Power Company has declared a quarterly dividend of $2 per share, payable July 1 to stock of record June 15.

Norfolk Railway & Light Company has declared a semi-annual dividend of 3 per cent, payable June 1 to stock of record May 15.

Electric Investment Corporation has declared a quarterly dividend of 1¾ per cent on the preferred stock, payable May 22 to stock of record May 11.

UNITED GAS & ELECTRIC CORPORATION.

The United Gas & Electric Corporation operating results of its subsidiary companies for the year ended December 31 last:

	1917.	1916.
Gross earnings	$16,287,275	$15,160,156
Operating expenses and maintenance	8,998,329	7,731,247
Net income	7,288,946	7,428,000
Taxes	1,156,370	957,100
Gross corporate income	6,132,576	6,461,809
Fixed charges	3,575,989	3,503,165
Balance available for dividends, etc.	2,556,587	2,958,643
Fixed charges	3,575,989	3,503,166

The balance sheet as of December 31 last shows cash in banks and on hand of $249,578; profit and loss surplus, $803,075, and total assets and liabilities of $46,482,272.

WESTERN STATES GAS & ELECTRIC COMPANY.

Net earnings of the Western States Gas & Electric Company for March show an increase of 5.7 per cent over those for March, 1917, and the net for the year ended March 31 shows an increase of 5.4 per cent over the corresponding previous period. Comparative statement is reported as follows:

March.	1918.	1917.
Gross earnings	$ 125,789	$ 107,541
Net earnings	51,946	49,133
Year.		
Gross earnings	1,456,568	1,270,176
Net earnings	639,249	606,507

The March earnings of the Northern Texas Electric Company show a surplus after charges of $107,493, with an increase of $51,303.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid May 7.	Bid May 14.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	6	13	12
Adirondack Electric Power of Glens Falls, preferred	6	70	80
American Gas & Electric of New York, common	10+extra	87	86
American Gas & Electric of New York, preferred	6	40	39½
American Light & Traction of New York, common	..	190	190
American Light & Traction of New York, preferred	6	94½	94½
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	..	..
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	6	..	..
American Telephone & Telegraph of New York	..	96¼	98
American Water Works & Elec. of New York, common	..	5	4⅞
American Water Works & Elec. of New York, particip.	7	13	13
American Water Works & Elec. of New York, first preferred	..	58	57
Appalachian Power of Bluefield, common	..	2¼	3¼
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	205	212
Cities Service of New York, preferred	6	74¼	73
Commonwealth Edison of Chicago	8	102¾	103
Comm. Power, Railway & Light of Jackson, common	..	20	21
Comm. Power, Railway & Light of Jackson, preferred	6	44	44
Federal Light & Traction of New York, common	..	6½	6½
Federal Light & Traction of New York, preferred	..	29½	30
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	24	..
Middle West Utilities of Chicago, preferred	6	57	53
Northern States Power of Chicago, common	ex.div.7	43	43
Northern States Power of Chicago, preferred	ex.div.7	85	84½
Pacific Gas & Electric of San Francisco, common	..	33	34
Pacific Gas & Electric of San Francisco, preferred	6	80	81
Public Service of Northern Illinois, Chicago, common	7	73¼	73¾
Public Service of Northern Illinois, Chicago, preferred	6	86	86
Republic Railway & Light of Youngstown, common	4	22¼	22½
Republic Railway & Light of Youngstown, preferred	6	56½	58
Standard Gas & Electric of Chicago, common	..	4	4½
Standard Gas & Electric of Chicago, preferred	6	24	24½
Tennessee Railway, Light & Power of Chattanooga, common	..	2¼	2¼
Tennessee Railway, Light & Power of Chattanooga, preferred	6	9¾	9¾
United Light & Railways of Grand Rapids, common	4	28	29½
United Light & Railways of Grand Rapids, preferred	6	59	62
Western Power of San Francisco, common	..	12	12
Western Power of San Francisco, preferred	6	50	49½
Western Union Telegraph of New York	extra	96¼	94
Industrials—			
Electric Storage of Philadelphia, common	4	49	49½
General Electric of Schenectady	8	142	148
Westinghouse Electric & Mfg. of Pittsburgh, common	+extra	40¾	41½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	59	62

*Last sale.